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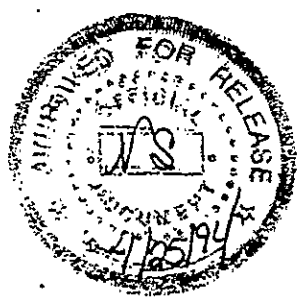

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7. Abstract

WHC, 1994, *Vitrification Testing of Soil Fines From Contaminated Hanford 100 Area and 300 Area Soils*, WHC-SD-EN-TI-240, Rev. 0, prepared by R.A. Merrill, Pacific Northwest Laboratory, for Westinghouse Hanford Company, Richland, Washington.

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ACRONYMS

EPA	U.S. Environmental Protection Agency
ICP/AES	inductively coupled plasma/atomic emission spectroscopy
PNL	Pacific Northwest Laboratory
RCRA	*Resource Conservation and Recovery Act*
TCLP	Toxicity Characteristic Leaching Procedure
WHC	Westinghouse Hanford Company

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1.0 INTRODUCTION

This report describes the results of crucible scale vitrification tests of soil fines carried out by Pacific Northwest Laboratory (PNL) under the statement of work provided in Appendix A. The soil fines tested include both nonradioactive surrogate from the 600 Area and actual radioactive soil fines from the 100 and 300 Areas. The nonradioactive surrogate came from a pilot scale soil-washing test using uncontaminated soil conducted at the Hanford Geotechnical Development Test Facility in the 600 Area. The 100 Area sample came from laboratory scale tests conducted on soil taken from the 116-D-1B Trench in Operable Unit 100-DR-1 (DOE-RL 1994). The 100 Area soil fines were generated by dry sieving a sample of the 116-D-1B soil to <2 mm, followed by wet sieving of the <2 mm fraction with deionized water to <0.25 mm. The <0.25 mm soil fines and washwater were collected and dried, and a portion of this material was obtained for use in the vitrification tests. The 300 Area sample came from a pilot scale soil-washing test conducted at the 316-2 North Process Pond of Operable Unit 300-FF-1 in June of 1993 using equipment obtained from the U.S Environmental Protection Agency (EPA) (DOE-RL 1993). These soil fines are representative of fines produced by processing soil that was located near the inlet at the southwest corner of the process pond.

Basic physical and chemical properties of the materials were determined. Melts were carried out with about 100 g of material at a temperature of 1450°C. Nine different glass compositions were formulated using the surrogate material, and the results of these tests were used to choose the glass formulation for use with the radioactive test materials. Radioactive samples from both the 100 and 300 Areas were vitrified, and the resulting products were tested for durability (by a slightly modified version of the Toxicity Characteristic Leaching Procedure [TCLP]) and for processability (electrical conductivity and viscosity). Results of these tests are presented in the following chapters. Analytical laboratory data are provided in Appendix B.

2.0 CHARACTERIZATION OF THE SOIL FINES

Table 1 presents the physical description and characterization of the samples of soil fines that were used in these tests. The surrogate was received directly from Westinghouse Hanford Company (WHC) personnel. The 100 Area sample (identified as "100 Area Washed Soil, <0.25 mm, Batch 3, Bucket 3") and the 300 Area sample (identified as "300 Area, B08NM3, extra fines from slurry sample") were obtained from the organization within PNL performing gamma counting on the soil fines. The data in Table 1 are based on the as-received condition of the samples.

Table 2 reports the elemental composition of the soil fines samples as determined by sodium peroxide/potassium hydroxide fusions and inductively coupled plasma/atomic emission spectroscopy (ICP/AES) analysis. These values are compared to the typical range reported for Hanford soils. It appears that the composition of 100 Area samples differs somewhat from that of the other soil fines samples and bulk Hanford soil. The 100 Area soil fines appear to

Table 1. Physical Description and Properties of Soil Fines (As Received) Used in the Vitrification Tests.

	Soil Fines Sample		
	Surrogate	100 Area	300 Area
Description	A fairly coarse sand with a substantial amount of fine, powdery material mixed in with it.	The material was fine and powdery with no coarse grains (reported as <0.25mm). It had been dried before it was received.	The material was coarse grained similar to the surrogate (reported as <0.425mm). Since it was wet, it was not apparent if there were substantial fines mixed in.
Bulk Density	1.48	1.50	1.70
Moisture	2.2	1.0	18.6

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Table 2. Chemical Composition of the Soil Fines as Determined by ICP Analysis (wt% oxide).

				Typical Range of Hanford Soil*	
Oxide	Surrogate	100 Area	300 Area	Low	High
SiO_2	60.4	66.2	63.4	58.00	64.4
Al_2O_3	12.7	13.0	14.7	12.5	14.4
Fe_2O_3	9.0	5.9	8.2	8.2	11.5
CaO	5.7	3.8	5.1	5.4	6.8
Na_2O	3.2	3.6	1.1	2.7	3.2
K_2O	3.1	3.4	2.2	1.4	2.5
MgO	2.8	2.0	2.5	1.4	3.4
TiO_2	1.6	1.0	1.4	1.4	2.1
Other	1.6	1.1	1.2		

* Source: Buelt et al. (1987)

be higher in silica and lower in iron and calcia than both the other samples and the typical Hanford soil. This may be because this sample was composed of only the fine material (<0.25mm) present in the soil and did not have any of the larger grains present in the other samples. This indicates that the very fine fraction of materials washed from the soils may differ in composition from the bulk soil. The impact of the observed difference in composition for the 100 Area fines would be an increase in the glass viscosity relative to the same formulation using the bulk Hanford soil; however, the difference was not expected to be large. Therefore, existing data on the vitrification of Hanford soils were expected to be reasonably applicable to the soil fines.

The data for sodium are believed to be somewhat inaccurate due to problems with the sodium channel of the ICP. The error in the ICP measurement is estimated to be as large as plus or minus several absolute percent; therefore, the soda data are of questionable validity. Nevertheless, the effect of this error on the values of the other elements is small (less than a few relative percent). The measured values of sodium for the surrogate and 100 Area soil fines appear to be reasonably accurate, assuming the true value is in the range reported for typical Hanford soil. The measured soda content of the 300 Area soil fines appears to be low by a few percent. This would result in a final glass composition that is a few percent higher than the predicted composition. The uncertainty in the soda content of the soil fines does not significantly affect the glass formation in these tests but does decrease the ability to correlate the observed results to the alkali content of the glass.

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Table 3 presents the isotopic composition of the soil fines samples. These results were obtained from the organization within PNL performing the radiochemical analysis of the soil fines. The 100 Area results are calculated from the activities measured for two size fractions of the <0.25 mm soil fines (<0.074 mm and 0.074 mm to <0.25 mm) with the exception of strontium and plutonium, which are reported for the <2.0 mm size fraction (the only fraction for which information was available). The 300 Area soil fines had been wet sieved into different size fractions and each size had been fraction counted, so the activity for the 300 Area sample was calculated from the measured activities of the different sieve fractions of the sample and the mass fraction of soil fines in each size fraction.

3.0 RESULTS OF SURROGATE TESTING

Simple vitrification tests were carried out to demonstrate the applicability of vitrification to the soil fines and to obtain data with actual waste material. Data pertaining to the vitrification of Hanford soils are available as a result of past work in the development of in situ vitrification at PNL. Figure 1 presents reported data for the viscosity and electrical conductivity of melts of a typical Hanford soil. Using this data as a starting point, nine glass compositions were formulated using the surrogate soil fines (Table 4). Replicate melts of one of the formulations (SF9) were performed. The formulations bound compositions estimated to be processable (viscosity of about 100 poise) in melter operating range of 1400°C to 1550°C.

Table 3. Reported Isotopic Composition of Soil Fines Samples Used in the Vitrification Tests (pCi/g).

Isotope	100 Area	300 Area
^{60}Co	36	--
^{90}Sr	12.5*	--
^{137}Cs	499	--
^{152}Eu	579	--
^{238}U	--	605
$^{239/240}Pu$	2.74*	--

-- Not Detected
* From the <2 mm size fraction rather than <0.25 mm

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All of the surrogate formulations formed a homogeneous black glass, typical of melts made from Hanford soil. Some small white inclusions were found around the crucible wall at the melt surface in most of the melts. These are thought to be undissolved silica particles from the starting material and are often seen in melts of Hanford soils.[1] The more fluid melts (SF1, SF6) did not have these crystals, as would be expected since the more fluid melt increases the dissolution rate of the silica particles. Qualitative viscosity checks by pouring the hot melt found reasonable agreement between the data reported in Figure 1 and the observed melt viscosities. If anything, the melts were a little more fluid than the reported data for Hanford soil. As expected, the general trend observed was decreasing viscosity as the amount of CaO or Na_2O increased. Melts with the lowest additives (SF2, SF5, SF8) were a little too viscous at 1450°C. The remainder of the melts appeared to have a viscosity in a reasonable processing range.

The leach resistance of the glasses was determined by a slightly modified version of the TCLP. The procedure followed is provided in Appendix C. The TCLP is normally used as a means of characterizing a material as hazardous or nonhazardous, depending upon the leachate concentrations of certain regulated metals. In order to use this test as a measure of glass durability, the leachate concentration is measured for the major elemental constituents in the glass, not just the regulated metals. Additionally, the leachate concentrations of the major elemental constituents must be related to the initial concentration of the constituent in the glass. This is achieved by expressing the leaching results as the "fractional release" rather than the

[1]The presence of the undissolved silica on the surface of the melt is not of particular concern at this stage of development (crucible melts). Such effects are often caused by interaction of the molten glass with the crucible, and incomplete dissolution or volatilization from the melt surface (which leads to silica enrichment). The bulk of the glass was homogeneous and free from inclusions and is representative of the product expected from a continuous melter.

Figure 1. Viscosity (100 Poise Temperature) and Electrical Conductivity for the Hanford Soil-Na_2O-CaO Ternary (From Buelt et al. 1987).

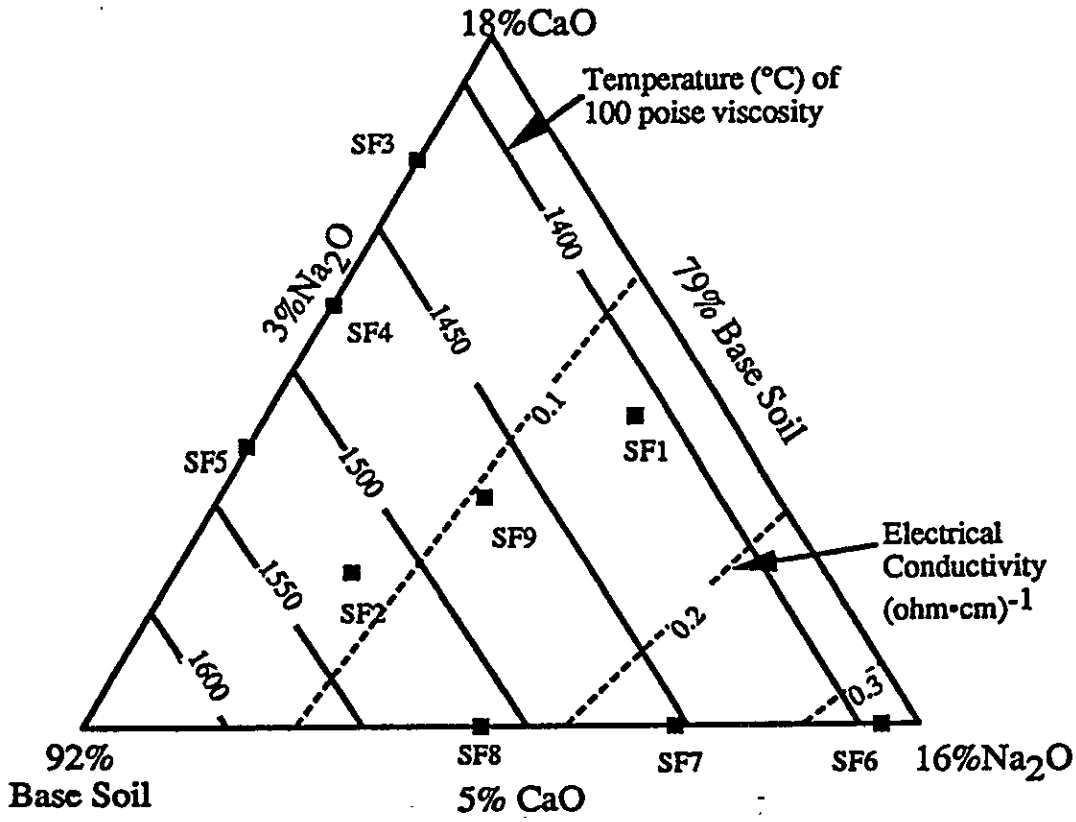

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Table 4. Soil Fines Surrogate Melt Formulations.

Melt	Target Composition (wt%)[a]			Melt Formulation (g material)		
	Base	CaO	Na_2O	Surrogate[b]	$Ca(OH)_2$	Na_2CO_3[c]
SF1	81.0	10.0	9.0	102.25	8.40	14.09
SF2	86.5	7.5	6.0	102.25	3.94	6.60
SF3	82.0	15.0	3.0	102.25	15.63	0.72
SF4	84.5	12.5	3.0	102.25	11.38	0.53
SF5	87.0	10.0	3.0	102.25	7.36	0.33
SF6	80.0	5.0	15.0	102.25	0.99	27.82
SF7	83.0	5.0	12.0	102.25	0.71	20.11
SF8	86.0	5.0	9.0	102.25	0.46	12.94
SF9-1	83.7	8.8	7.5	102.25	6.09	10.23
SF9-2	83.7	8.8	7.5	102.25	6.09	10.23
SF9-3	83.7	8.8	7.5	102.25	6.09	10.23

[a]Surrogate composition assumed to be that of soil used to obtain data in Figure 1
[b]Moisture content of 2.2%
[c]Moisture content of 12.4%

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measured concentration in the leachate. The fractional release is just the mass of an element in the leachate (Appendix D) divided by the total mass of that element initially present in the sample being leached (see Table 2). This calculation also uses a 50 g/L TCLP slurry concentration (see Appendix C). The fractional release expresses the fraction of an element that was leached from the sample and into solution.

Table 5 presents results from the leach testing of the surrogate melts. Leaching from the glasses was low and quite similar for all the formulations. All the formulations produced a durable glass product; however, in order to determine the formulation for use in the radioactive melts, a simple ranking system was developed. The melts were placed in order of increasing fractional release for each element measured. One point was awarded to the most leach resistant melt, two points for the next, and so on. The points received for each element were summed and the melts were arranged by this total score. The melts and the point totals are presented in Table 6. Adjacent melts in this ranking are not statistically different, but the extremes (i.e., melt SF9 compared to SF6) are different. Choice of the most suitable formulation for the radioactive melts cannot be based solely upon the leaching results. A somewhat arbitrary choice was made based partly upon the leaching results and partly upon visual observations of the melts (qualitative viscosity and appearance), and the formulation of melt SF9 was chosen for the radioactive melts.

Table 5. TCLP Fractional Release of Major Constituent Metals From the Surrogate Melts.

Melt	Aluminum	Calcium	Iron	Magnesium	Silicon	Titanium
SF1	5.5E-05	2.8E-04	7.4E-05	2.1E-04	4.0E-05	1.7E-05*
SF2	7.5E-05	1.7E-04	7.6E-05	2.6E-04	4.1E-05	2.3E-05*
SF3	6.6E-05	4.4E-04	8.2E-05	3.0E-04	4.1E-05	2.0E-05*
SF4	1.1E-04	2.2E-04	8.8E-05	3.8E-04	4.9E-05	3.4E-05*
SF5	7.3E-05	2.9E-04	8.1E-05	2.7E-04	3.8E-05	1.9E-05*
SF6	1.0E-04	2.9E-04	1.2E-04	3.6E-04	5.8E-05	3.2E-05*
SF7	9.9E-05	2.1E-04	1.0E-04	3.5E-04	4.8E-05	3.0E-05*
SF8	4.0E-05	1.8E-04	1.4E-04	6.1E-05	4.5E-05	1.7E-05*
SF9-1	1.8E-05	2.1E-04	5.8E-05	4.9E-05	3.3E-05	6.5E-06*
SF9-2	2.4E-05	2.6E-04	9.6E-05	6.8E-05	4.0E-05	9.1E-06*
SF9-3	4.4E-05	2.3E-04	9.1E-05	1.3E-04	4.0E-05	1.5E-05*

*TCLP result was less than detection limit. Value was used to rank glass formulations only.

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Table 6. Ranking of the Surrogate Glass Formulations by TCLP Leach Resistance.

Melt	Sum of Rankings
SF9-1	8
SF1	27
SF9-2	27
SF9-3	28
SF8	31
SF2	32
SF5	35
SF3	44
SF7	49
SF4	54
SF6	61

4.0 RESULTS OF MELTS OF THE 100 AREA AND 300 AREA SOIL FINES

The formulation of melt SF9 was chosen for use in the radioactive melts based upon results from the surrogate melts. Table 7 reports the formulations for melts using the 100 Area and 300 Area soil fines. Three melts of each formulation were carried out at a temperature of 1450°C. Two melts of each formulation were heated to 1450°C and held for 2 to 3 hours, then allowed to cool within the furnace as the furnace was turned off. The third melt of each formulation was heated in a similar manner but cooled on a programmed temperature profile at a rate of 20°C/hr down to a temperature of 500°C. This cooling rate is representative of the slow cooling that would take place in the center of a large, monolithic casting of glass (such as a 2-ft-thick slab). The effects of these different cooling rates on leaching of the glass are considered below. Table 8 reports the calculated (by mass balance) and analyzed (by ICP) compositions of the glasses. Table 9 presents the densities of the glasses and the calculated volume reduction achieved through vitrification. The volume reduction is expressed as the final volume of the vitrified material (waste and additives) expressed as a percent of the initial waste volume.

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The melts of both the 100 Area and 300 Area soil fines were similar in appearance to the surrogate melts described above. There were no visible differences between the rapidly cooled melts (100SFR1, 100SFR2, 300SFR1, 300SFR2) and the slowly cooled melts (100SFR3, 300SFR3), indicating that these glasses were very resistant to devitrification, at least to the extent that it is visible to the naked eye. The leaching data (presented below) also show no indication of differences in leaching due to the slow cooldown rate.

Results of TCLP leach testing of both the raw and vitrified soil fines are presented below. Table 10 reports the elemental fractional release for the major elements in the wastes. Leaching from the vitrified soil fines is seen to be reduced significantly (up to 2 orders of magnitude) relative to the unvitrified material. Figure 2 compares the fractional release of the vitrified soil fines to that of various other natural and man-made glasses. The vitrified soil fines are seen to be among the most leach resistant of these materials, demonstrating excellent durability. Table 11 presents the leachate concentrations of TCLP metals that were present in the initial waste (arsenic, mercury, and selenium were not available by ICP/AES analysis). Leachate concentrations from both the vitrified and nonvitrified soil fines are well within the regulatory limits.

Table 12 presents the leachate concentrations for the most prevalent isotopes in the waste. The leachate concentrations of ^{60}Co, ^{137}Cs, ^{52}Eu, and ^{154}Eu were measured by gamma spectroscopy, while ^{238}U was measured by uranium fluorimetry. Analysis of the uranium in the 300 Area leachate found the isotopic distribution to be (mass%): ^{234}U - 0.0055, ^{235}U - 0.7286, ^{236}U - 0.0025, ^{238}U - 99.2634. Upper limits for ^{90}Sr and $^{239/240}Pu$ were determined by a total alpha/beta screening assuming that all alpha activity resulted from $^{239/240}Pu$ and all beta activity other than the known beta emitters ^{137}Cs and ^{152}Eu resulted from ^{90}Sr. The low activity of the leachates from the vitrified 100 Area soil required that the three samples be combined into a single sample to achieve lower detection limits.

Table 7. Melt Formulations for the 100 and 300 Area Soil Fines (grams of material).

Sample	Soil Fines[a]	$CaCO_3$	Na_2CO_3[b]
100 Area	202.0	16.5	17.9
300 Area	245.7	15.5	24.9

[a]Moisture content of 1.0% for 100 Area, 18.6% for 300 Area
[b]Moisture content of 0.5%

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Table 8. Calculated and Analyzed Compositions of the Vitrified Soil Fines (wt% oxide).

Oxide	100 Area		300 Area	
	Calculated	Analyzed	Calculated	Analyzed
SiO_2	60.2	58.9	56.9	60.2
Al_2O_3	11.8	15.0	13.2	12.7
CaO	7.6	8.6	8.5	8.9
Fe_2O_3	5.43	5.7	7.4	7.3
Na_2O	8.0	5.5	7.5	5.0
K_2O	3.1	2.4	2.0	1.6
MgO	1.8	1.9	2.2	2.1
TiO_2	0.9	0.9	1.3	1.2
other	1.0	1.0	1.1	0.9

Table 9. Glass Density and Volume Reduction for Vitrified Soil Fines.

Sample	Glass Density (g/cm^3)	Glass Volume as a % of Initial Bulk Soil Volume
Surrogate	2.63	60
100 Area*	2.6	63
300 Area*	2.6	59

* Estimated Density

Table 10. TCLP Fractional Release of Major Constituent Metals for Vitrified and Nonvitrified Soil Fines From the 100 Area and 300 Area.

Source of Soil Fines	Material	Sample ID	Al	Ca	Fe	Mg	Si	Ti
100 Area	Soil	100 Soil	6.0E-05	7.3E-02	LD	1.3E-02	3.8E-04	LD
	Glass 1	100SFR1	LD	1.7E-04	6.3E-05	LD	3.3E-05	LD
	Glass 2	100SFR2	LD	2.5E-04	3.1E-04	LD	3.7E-05	LD
	Glass 3	100SFR3	4.8E-05	1.3E-04	1.9E-04	LD	3.3E-05	LD
300 Area	Soil	300 Soil	1.8E-03	7.1E-02	1.8E-05	1.9E-02	2.3E-03	LD
	Glass 1	300SFR1	4.3E-05	1.5E-04	4.5E-04	LD	4.3E-05	LD
	Glass 2	300SFR2	3.4E-05	2.3E-04	2.1E-04	1.7E-04	3.6E-05	LD
	Glass 3	300SFR3	4.4E-05	2.5E-04	1.9E-04	1.8E-04	4.1E-05	LD

LD = TCLP result was less than detection limit

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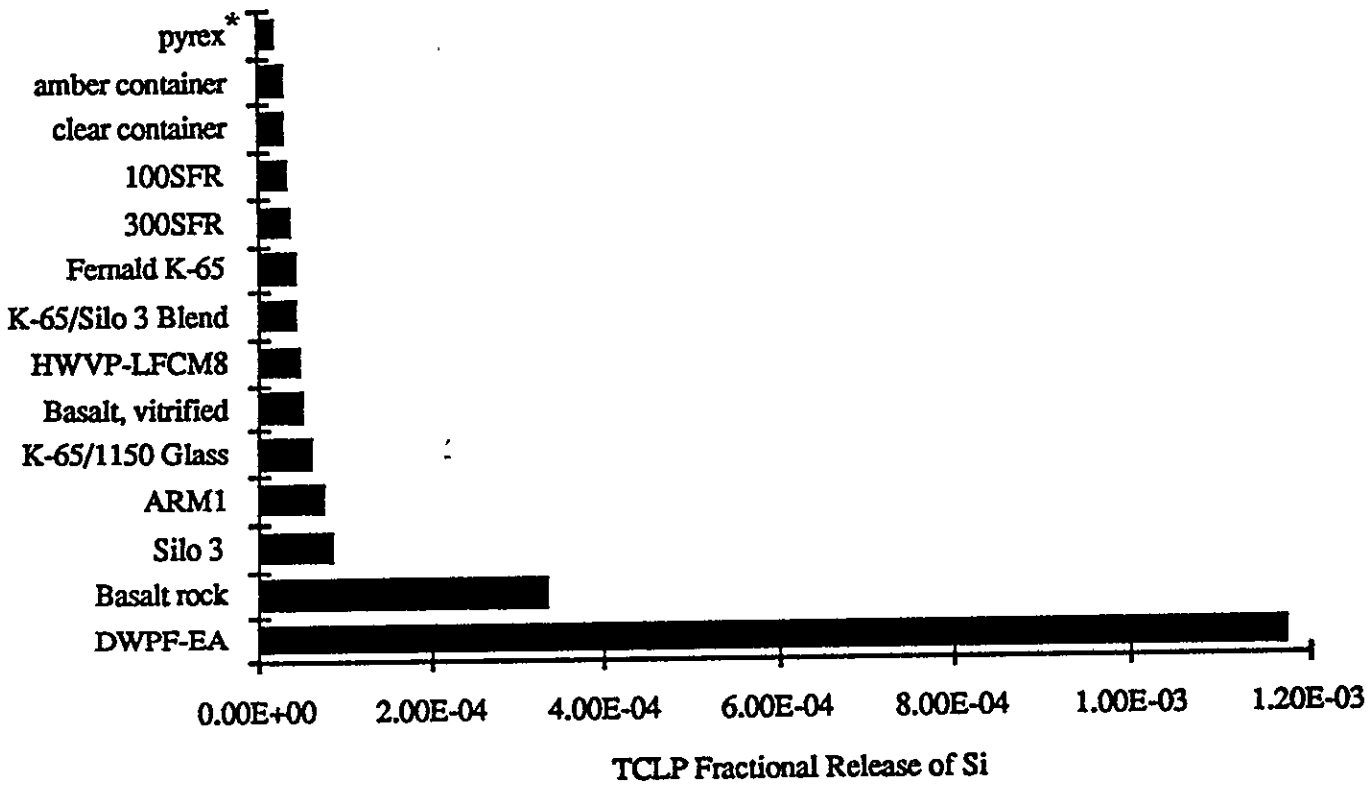
Significant leaching (compared with that of the vitrified product) of the radionuclides was observed from the untreated material. Using the data provided in Tables 3 and 12 and the fact that a slurry concentration of 50 g/L is used to perform the extraction (Appendix C), a mass balance can be calculated. About 0.15% of the ^{137}Cs and 0.7% of the ^{152}Eu was leached from the untreated 100 Area soil fines, while 200% of the reported uranium was leached from the 300 Area soil fines. Initially ^{60}Co and ^{154}Eu were present in smaller amounts and were below detection limits for the counting time used.

The leaching of uranium from the untreated waste seems to indicate a higher concentration in the soil fines than that reported in Table 3. The initial uranium concentrations reported in Table 3 for the 300 Area soil fines were a composite of data on several size fractions; however, discussion with the group that performed the sieving and analysis indicated that significant amounts of uranium were observed in the water used in the wet sieving process. Since the sample used in the vitrification tests had not been through this wet sieving process, it appears that its activity could be substantially higher than that calculated from the sieved size fractions. The high uranium concentrations in the TCLP leachate from the untreated 300 Area soil fines sample support the idea that substantial amounts of uranium could have been removed by the wet sieving process.

All isotopes were below detection limits in the leachate from the vitrified 100 Area soil fines. The leachate concentrations of ^{238}U from the vitrified 300 Area soil fines represent a reduction in leaching of about 2,000 to 5,000 times relative to the unvitrified material. These results confirm the ability of the vitrified material to retain the radionuclides of concern and prevent their release to the environment.

The glass viscosity and electrical conductivity of these glasses were measured as a function of temperature. Figures 3 and 4 present the results of

Figure 2. TCLP Fractional Release of Silicon from Vitrified Soil-Washing Fines Compared to Other Natural and Man-made Glasses.



* A trademark of Corning Glass Works, Corning, New York.

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Table 11. TCLP Leachate Concentrations of Regulated Metals Present in the Soil Fines. (Arsenic, Mercury, and Selenium were not analyzed. Other RCRA regulated metals were less than detection limit.)

100 Area Soil Fines				
Element	Wt% Oxide in Waste	Leachate Concentration (mg/L)		RCRA Regulatory Level* (mg/L)
		Nonvitrified	Vitrified	
Ba	0.12	0.467	LD	100
Cr	0.01	LD	LD	5.0
300 Area Soil Fines				
Element	Wt% Oxide in Waste	Leachate Concentration (mg/L)		RCRA Regulatory Level* (mg/L)
		Nonvitrified	Vitrified	
Ba	0.15	9.580	0.014	100
Cr	0.04	0.122	LD	5.0

* Title 40, *Code of Federal Regulations*, Part 261.24
LD=Less than detection limit

Table 12. TCLP Leachate Concentrations of Various Isotopes for Vitrified and Nonvitrified Soil Fines from the 100 Area and 300 Area (pCi/L).

Source of Soil Fines	Material	Sample ID	^{60}Co	^{90}Sr	^{137}Cs	^{152}Eu	^{154}Eu	^{238}U	$^{239/240}Pu$
100 Area	Soil	100 Soil	<56	250*	37	200	<90	--	<20
	Glass 1,2, & 3	100SFR1,2,3	<4	<80	<4	<17	<10	--	<35
300 Area	Soil	300 Soil	--	--	--	--	--	60,500	--
	Glass 1	300SFR1	--	--	--	--	--	13	--
	Glass 2	300SFR2	--	--	--	--	--	30	--
	Glass 3	300SFR3	--	--	--	--	--	22	--

-- Not Analyzed
*Assumes all beta activity except that from ^{137}Cs and ^{152}Eu was due to ^{90}Sr

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Figure 3. Glass Viscosity as a Function of Temperature.

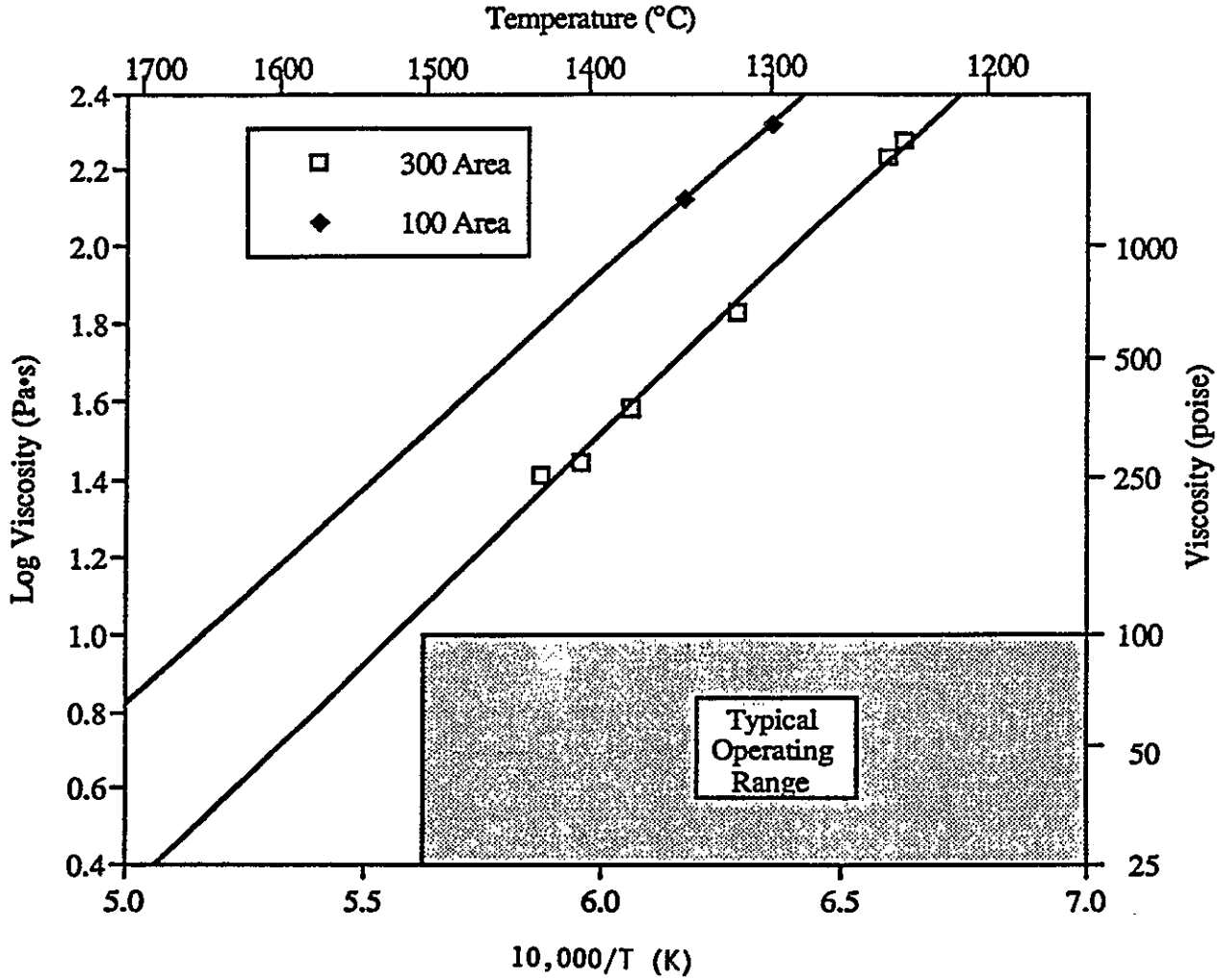

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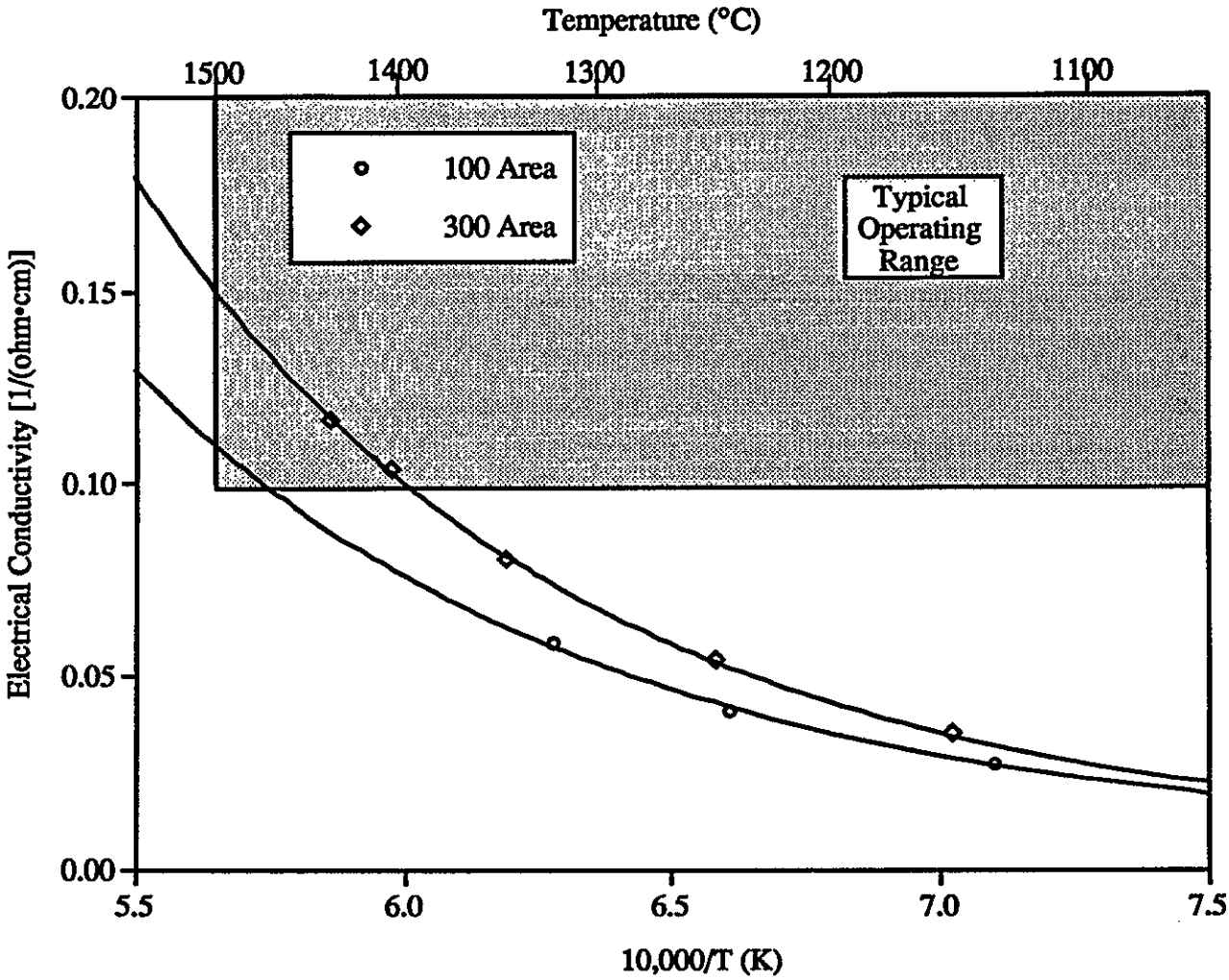
Figure 4. Electrical Conductivity as a Function of Temperature.



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these measurements. These data show that the glass formulations used in these tests for the 100 and 300 Area soil fines require further development prior to processing. The viscosity of both glasses was higher than the typical maximum of 100 poise at operating temperatures, while the electrical conductivity was at the boundary of the typical process limits for a joule-heated glass melter (0.1 to 0.5 $ohm^{-1} \cdot cm^{-1}$). Both of these parameters can be brought within the typical operating ranges by increased flux additions (soda, calcia) in the formulations. Further refinement of the conductivity is achievable by adjusting the relative proportions of soda and calcia in the formulations. Leaching results from the surrogate melts demonstrate that substantial increases in the amount of soda and calcia added can be achieved without compromising the leach resistance of the glass.

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5.0 SUMMARY AND CONCLUSIONS

The suitability of Hanford soil for vitrification is well known and has been demonstrated extensively in other work. The tests reported here were carried out to confirm the applicability of vitrification to the soil fines (a subset of the Hanford soil potentially different in composition from the bulk soil) and to provide data on the performance of actual, vitrified soil fines. It was determined that the soil fines were generally similar in composition to the bulk Hanford soil, although the fraction <0.25 mm in the 100 Area soil sample appears to differ somewhat from the bulk soil composition. The soil fines are readily melted into a homogeneous glass with the simple additions of CaO and/or Na_2O. The vitrified waste (plus additives) occupies only 60% of the volume of the initial untreated waste. Leach testing has shown the glasses made from the soil fines to be very durable relative to natural and man-made glasses and has demonstrated the ability of the vitrified waste to greatly reduce the release of radionuclides to the environment. Viscosity and electrical conductivity measurements indicate that the soil fines will be readily processable, although with levels of additives slightly greater than used in the radioactive melts. These tests demonstrate the applicability of vitrification to the contaminated soil fines and the exceptional performance of the waste form resulting from the vitrification of contaminated Hanford soils.

5.0 REFERENCES

40 CFR 261.24, 1993, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

Buelt, J.L., C.L. Timmerman, K.H. Oma, V. Fitzpatrick, 1987, *In Situ Vitrification of Transuranic Wastes: An Updated Systems Evaluation and Applications Assessment*," PNL-4800, Suppl. 1, Pacific Northwest Laboratory, Richland, Washington.

DOE-RL 1993, *300-FF-1 Operable Unit Remedial Investigation Phase II Report: Physical Separation of Soils Treatability Study*, DOE/RL-93-96, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1994, *100 Area Soil Washing Bench-Scale Tests*, DOE/RL-93-107, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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APPENDIX A

SOIL FINES VITRIFICATION CRUCIBLE TESTS

STATEMENT OF WORK

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Westinghouse
Hanford Company

P.O. Box 1970 Richland, WA 99352

August 20, 1993 9356804

Mr. R. A. Merrill
Pacific Northwest Laboratory
Post Office Box 999
Richland, WA 99352

Dear Mr. Merrill:

CRUCIBLE VITRIFICATION TESTS OF SOIL WASHING FINES

The attached statement of work and accompanying supplemental work order (ED3870) are being provided to you to complete crucible vitrification tests of soil washing fines. The two main purposes of these tests are to: 1) demonstrate the durability of the glasses using various combinations of additives; and 2) provide experimental evidence of the quality of the vitrified product using actual (contaminated) feed soils.

If you have any questions, please contact Mr. J. D. Ludowise of my staff on 376-6470.

Very truly yours,

J. G. Woolard, Manager
Environmental Engineering Support Group

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Attachment

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Attachment

STATEMENT OF WORK

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SOIL FINES VITRIFICATION CRUCIBLE TESTS STATEMENT OF WORK (WORK ORDER ED3870)

1.0 INTRODUCTION

This statement of work is for Pacific Northwest Laboratory (PNL) to conduct crucible scale vitrification tests of soil washing fines. The two main purposes of these test are to: 1) demonstrate the durability of the glasses using various combinations of additives; and 2) provide experimental evidence of the quality of the vitrified product using actual (contaminated) feed soils. This information will feed into the design of pilot scale ex situ vitrification tests (regardless of the melter type).

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The *Treatability Study Program Plan* (DOE-RL 1992) identifies ex situ vitrification as a technology that requires treatability testing prior to selection as a method to stabilize the fines from soil washing. The *Guide for Conducting Treatability Studies under CERCLA* (EPA 1992) defines a protocol to acquire cost and performance data through treatability testing. This protocol is a three-tiered approach as follows:

- Remedy screening testing to determine potential feasibility of a particular remedial technology
- Remedy selection testing to develop performance and cost data to support focused feasibility studies and Records of Decision (RODs)
- Remedial design/remedial action testing to develop detailed design and cost data to confirm performance (EPA 1992).

Each of these three tiers is progressively more focused and the size of the equipment used ranges from bench-scale to full-scale. Each tier of treatability testing has specific data objectives and associated analytical quality. The screening type tests are generally of a short duration, providing qualitative results at a lower level of quality assurance.

A series of crucible tests followed by batch tests and continuous runs is required for remedy screening/remedy selection of ex situ vitrification of soil washing fines. This is a common approach taken to evaluate the performance parameters and was followed at the Fernald site during evaluation of soil vitrification. The information obtained from the crucible tests identified below will support the development of batch/continues melter runs, which will be conducted at a higher level of quality assurance.

2.0 WORK SCOPE

The tests will be performed using both surrogate (non-contaminated) and actual (contaminated) soil wash fines. The surrogate will be non-contaminated soil washing fines from the Hanford Geotechnical Development and Test Facility in the 600 Area. The surrogate fines will be provided by WHC. Additionally, soil washing fines from the 300 Area Process Ponds and the 100 Area laboratory treatability test will be used in a limited number of tests. A total of about

2 kg of surrogate soil will be required and about 0.75 kg of contaminated soil from each of the contaminated sites will be required. The following is a brief outline of the tasks to be performed.

Task 1: Characterize the Soil Materials

Both the surrogate and actual waste materials will be analyzed for metals by inductively coupled plasma (ICP) spectroscopy before vitrification testing. This is necessary to verify that the composition of the soil washing fines is similar to the bulk Hanford soil and also to provide the data necessary for accurate calculation of elemental release during leach testing of the vitrified product. Crucible test melts have been carried out in the past on bulk Hanford soils. Such data may be directly applicable to soil washing fines vitrification if the composition of the fines is shown to be similar to that of the bulk soil. The data from the comparison (between bulk and soil wash fines) will also be used to determine the combination of additives that may be required in task 2.

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Physical characterization of the materials will also be carried out (moisture content, bulk density) to allow determination of parameters such as the volume reduction and waste loading. Moisture content will be determined by drying at 105°C to constant weight and bulk density will be determined by measuring the volume occupied by a known mass of material.

Test to be performed:

2 samples for ICP analysis (surrogate)
1 sample for ICP analysis (100 Area soil)
1 sample for ICP analysis (300 Area soil)

Task 2: Perform Vitrification Test

Samples for the surrogate material will be vitrified using up to 12 different formulations (combinations of additives). Existing data from crucible melts on bulk Hanford soil will be used and modified as needed based upon results of the characterization of the soil washing fines. Additions of Na_2O and CaO will be made in varying amounts covering the range of acceptable viscosity and conductivity observed in previous tests. Glass formulations will be designed to be high melting (1400°C to 1500°C) in order to maximize durability and minimize additives. Surrogate melts will also provide samples of vitrified material (such as glass buttons) for use as visual aids in demonstrating the quality of the vitrified product. The formulation judged to be best will be used in melts of the radioactive soil washing fines.

Three melts using the actual waste material will be carried out for each of the contaminated soil samples using the formulation arrived at in the surrogate tests. In one of these three melts, the furnace will be cooled on a controlled temperature profile to approximate the cooling rate of a large monolith of glass. This will allow comparison of the leaching of a slow-cooled (potentially devitrified) glass with the other two glassed cooled at a faster rate (presumed vitreous). Samples of these glasses will be archived for possible future analysis for crystallinity and crystalline phases.

Tests to be performed:

12 melts (surrogate soil)
3 radioactive melts (100 Area soil)
3 radioactive melts (300 Area soil)

Task 3: Perform Leach Testing

The vitrified product will be evaluated for durability using the Toxicity Characteristic Leaching Procedure (TCLP) slightly modified to improve the applicability of the data for use as a measure of glass durability. The main modification of the TCLP is the use of a specific size fraction of crushed glass (-4mm/+1mm), which provides a better defined sample surface area for leaching. Leachate from the surrogate and actual glasses will be analyzed for metals by ICP and the fractional release for each element determined. Additionally, the leachate from the radioactive glasses will be analyzed for the predominant nuclides in the wastes.

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Test to be performed:

12 non-radioactive TCLP with metals analysis by ICP
6 radioactive TCLP with metals analysis by ICP
6 isotopic analyses on the TCLP leachate by gamma spectroscopy (^{60}Co, ^{90}Sr ^{137}Cs, ^{152}Eu, and ^{154}Eu, and $^{239/240}Pu$ for 100 Area soil; ^{235}U and ^{238}U for 300 Area soil)

Task 4: Conductivity and Viscosity Analysis

The viscosity and electrical conductivity as a function of temperature will be measured for one of each of the radioactive melts. The viscosity will be measured by a rotating spindle method and the conductivity will be determined by measuring the resistance between platinum electrodes submerged in the molten glass. The conductivity and viscosity are important parameters in determining the processability of the glass. The conductivity must be in the correct range to allow joule-heating of the molten glass, while the viscosity affects the ability to process the waste (melt rate, mixing in and removal from the melter).

Tests to be performed:

Viscosity and conductivity for two radioactive melts (1 each of the 100 and 300 area soils).

Tasks 5: Data Analysis and Report

The data obtained will be analyzed and summarized and a letter report prepared and transmitted to WHC. The report shall be written and formatted as a WHC-SD-TI-XX supporting document. A disk copy of the final report shall also be submitted upon completion. Copies of data collected during testing shall be included either as attachments to the report, or submitted separately to WHC. The report will include:

o An introduction and description of the tests

- o Results of material characterization (composition, bulk density, moisture content)
- o Results of surrogate testing (formulation tested, melt observations, TCLP results)
- o Results of actual material tests (formulations, viscosity and conductivity as a function of temperature, TCLP results for major elements and isotopes)
- o Summary and conclusions.

Most of the data will be presented in the form of tables and figures accompanied by a brief written discussion of the content. The results of the tests will be discussed and summarized in the summary and conclusions section.

3.0 Deliverables/Schedule

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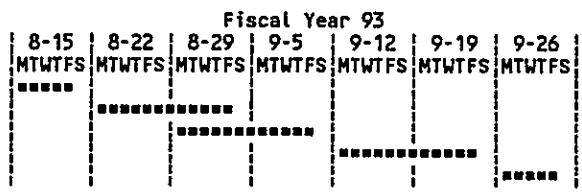
Task	Duration, Weeks	Start	End
1 Characterize Soil Materials	1	16-Aug-93	20-Aug-93
2 Perform Vitrification Tests	2	23-Aug-93	03-Sep-93
3 Perform Leach Testing	2	30-Aug-93	10-Sep-93
4 Cond. and Viscosity Analysis	2	13-Sep-93	24-Sep-93
5 Data Analysis and Report	1	27-Sep-93	01-Oct-93



4.0 MATERIALS AND WASTE DISPOSAL

Waste materials generated during the test shall be handled by PNL. Vitrified samples will be archived and kept until it is apparent that no further analyses are required, after which they will be disposed of by PNL. PNL will check with WHC prior to disposing of samples.

5.0 COST ESTIMATES

The work described in this statement of work will be charged to Work Order ED3870. The cost estimate is broken down as shown below:

Task 1: Characterize the Soil Materials	$ 2.0K
Task 2: Perform Vitrification Tests	5.0K
Task 3: Perform Leach Testing	6.0K
Task 4: Conductivity and Viscosity Analysis	5.0K
Task 5: Data Analysis and Report	5.0K
Materials/Waste Disposal	2.0K
Total Cost of Proposed Work	25.0K

6.0 QUALITY ASSURANCE

Work on this project will be carried out as PNL Impact Level III and will comply with the GPS Standards located in Part 2 of PNL-MA-70. Laboratory notebooks will be used to record the experimental activities carried out under this scope of work.

7.0 POINT OF CONTACT

The WHC technical point of contact of work performed under this statement of work is J. D. Ludowise (telephone 376-6470).

8.0 REFERENCES

DOE-RL, 1992, *Treatability Study Program Plan*, DOE/RL-92-48, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 1992, *Guide for Conducting Treatability Studies under CERCLA*, EPA/540/R-92/071a, U.S. Environmental Protection Agency, Washington, D.C.

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APPENDIX B

ANALYTICAL DATA

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BULK DENSITY DATA SHEET

PNL Procedure: AMT-02 Rev. 0

Date: 8/23/93 Analyst(s): RA Merrill

Balance #: 452-01-01-001

Sample	1 Mass of Cylinder (g)	2 Mass Cylinder + Sample (g)	3 Sample Volume (mL)	Bulk Density (g/cm^3) = (2 - 1) / 3
SF-A	55.52	86.73	21.0	~~1.49~~ 1.4862
SF-B	"	85.39	20.4	1.4642
SF-C	"	86.10	20.6	1.4845
				Avg. 1.478 ± .012

Three samples of 600 Acq Surrogate

RA Merrill
AMT-02 Data
8/20/93

BULK DENSITY DATA SHEET

PNL Procedure: AMT-02 Rev. 0

Date: 9/8/93 Analyst(s): Gene Huntington

Balance #:

Sample	1 Mass of Cylinder (g)	2 Mass Cylinder + Sample (g)	3 Sample Volume (mL)	Bulk Density (g/cm^3) = (2 - 1) / 3
RSF 100 Area Soil Fines	90.4	148.8	39.0	1.50
300 Area Soil Fines	(69.6 g soil)		41 mL	1.70

From BNW-5521 p9 11 zaun 1/7/94

PNL-3276-0797

RA Merrill
AMT-02 Data
8/20/93

MOISTURE CONTENT DATA SHEET

PNL Procedure: AMT-03 Rev. 0

Date: 8/23/93 Analyst(s): RA Merrill

Balance #: 452-06-01-001 (Metler, PC2000 Lab 21a)

Oven: Blue M Prop# WA 7258 | TC# 592

Readout T-69990 Exp 5/93

3 Samples of 600 Area Nat + Rad Surrogate

	Sample	Mass Dish (g)	Mass Dish + Sample (g)	Mass Dry Sample + Dish (g)	% Moisture
1	SF-A	1.34g	22.94	22.43	2.3611
2	SF-B	1.32g	27.74	27.16	~~2.20~~ 2.1953
3	SF-C	1.32g	27.69	27.14	2.0857
4					Avg. 2.214 ± 0.139
5					

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Mass (g) of Samples as a Function of Time

Time (hr)	Sample 1	2	3	4	5
8:30 Start					
9:35	22.44	27.16	27.12		
10:36	22.43	27.16	27.14		
100 Area Soil Fines	1.0%	From LRB BNW 55211 pg 7		Measured with moisture balance	
300 Area Soil Fines	18.6%	From LRB BNW 55211 pg 11		" " " "	
			Raum 11/7/94		

RA Merrill
AMT-03 Data
8/20/93

RESULTS OF COMPOSITIONAL ANALYSIS OF SOIL WASH FINES SURROGATE BY ICP ANALYSIS

ICP Results (uncorrected) for Soil Wash Fines Surrogate

	SF1			SF2	
oxide	KOH	Na2O2		KOH	Na2O2
Si	40.08	52.15		52.37	59.76
Na	12.18			7.07	
Al	7.97	11.02		11.40	12.58
Fe	5.46	8.54		7.38	9.38
Ca	3.79	5.14		4.54	5.90
K		2.20			3.59
Mg	1.90	2.48		2.42	2.77
Ti	0.92	1.58		1.33	1.78
P	0.43	0.41		0.58	0.50
Nd	0.28	0.10		0.47	0.13
Pb	0.23			0.30	0.08
B	0.16	0.06		0.17	0.03
Mn	0.12	0.16		0.14	0.18
Ni		0.04			0.04
La	0.05	0.02		0.09	0.02
Li	0.04	0.02		0.07	0.01
Zr	0.04			0.06	
total	73.65	83.70		88.37	96.76
total-Na	61.47	83.70		81.30	96.76

ICP Results (corrected) for Soil Wash Fines Surrogate

SF1				SF2		
Na2O2	oxide	KOH		Na2O2	oxide	KOH
60.29	Si	61.45		59.76	Si	60.03
3.17	Na	3.17		3.17	Na	3.17
12.74	Al	12.23		12.58	Al	13.06
9.64	Fe	8.37		9.38	Fe	8.46
5.94	Ca	5.81		5.90	Ca	5.21
2.54	K	2.54		3.59	K	3.59
2.86	Mg	2.91		2.77	Mg	2.77
1.82	Ti	1.42		1.78	Ti	1.52
0.48	P	0.66		0.50	P	0.66
0.12	Nd	0.42		0.13	Nd	0.53
0.00	Pb	0.35		0.08	Pb	0.34
0.07	B	0.24		0.03	B	0.20
0.18	Mn	0.18		0.18	Mn	0.16
0.04	Ni	0.04		0.04	Ni	0.04
0.02	La	0.08		0.02	La	0.11
0.03	Li	0.07		0.01	Li	0.08
0.06	Zr	0.06		0.06	Zr	0.07
100.0	total	100.0		100.0	total	100.0
				96.8	total(no Na)	
				3.17	Na Content	
96.8	Other oxides	94.2			Other oxides	93.2

Average Corrected Wt% Oxide Soil Fines Surrogate

oxide	wt%		oxide	wt%
Si	60.38		Si	60.38
Al	12.65		Al	12.65
Fe	8.96		Fe	8.96
Ca	5.71		Ca	5.71
Na	3.17		Na	3.17
K	3.07		K	3.07
Mg	2.83		Mg	2.83
Ti	1.64		Ti	1.64
P	0.57		other	1.59
Nd	0.30			
Pb	0.19			
Mn	0.17			
B	0.13			
Zr	0.06			
La	0.06			
Li	0.05			
Ni	0.04			
total	100.0		total	100.0

After examining the data and discussion with the lab, it is apparent that some difficulty was had in fusing the samples. Additionally, the sodium channel on the ICP was giving inaccurate results. Following is a brief outline of the method used to analyze the data.

1. It was assumed that the Na2O2 fusion for SF2 was completely accurate. This is based on the observed silica numbers and the recovery achieved. The wt% zirconia was assumed to be equal to that of the KOH fusion and the soda was obtained by difference from 100%.

2. The KOH fusion for SF2 was corrected by assuming the Na wt% determined above and the K and Ni wt% determined in the Na2O2 fusion were correct. The other elements were normalized so the total oxide content was 100%.

3. The Na2O2 fusion for SF1 was corrected by assuming the Na and Zr wt% from item 1 above were correct. The other elements were normalized so the total oxide content was 100%. The other oxides were 100 - (Na,Zr).

4. The KOH fusion for SF1 was corrected in the same manner as item 2 above. The K and Ni data were from the corrected Na2O2 fusion of SF1, the Zr data was taken from the KOH fusion of SF2. The other oxides were 100 - (Na, K, Ni).

S-1 Fines Surrogate

ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0 ICP Analysis

The solutions from the fused samples were analyzed on the ICP at 324 Building

2.0	Lab No	1419-93			1419-93		
3.0	Customer	Merrill			Merrill		
4.0	Customer's ID	SF-1		400 Area SF Surrogate	SF-1		
5.0	Fusion Method	KOH	Na2O2		KOH	Na2O2	
6.0	Sample Wt	0.3132 g	0.3096 g		0.3132 g	0.3096 g	
7.0	Dilution	2500 mL	2500 mL		2500 mL	2500 mL	

8.0 Analysis

Element	Wt % Element	Wt % Element
Ag	-0.004%	-0.004%
Al	4.220%	5.833%
B	0.049%	0.018%
Ba	-0.002%	0.066%
Be	-0.002%	-0.002%
Bi *	0.093%	-0.048%
Ca	2.706%	3.672%
Cd	-0.005%	-0.005%
Ce *	0.193%	-0.032%
Co	-0.008%	-0.008%
Cr	-0.016%	-0.016%
Cu	-0.005%	-0.005%
Dy	-0.005%	-0.005%
Eu	-0.003%	-0.003%
Fe	3.819%	5.832%
K		1.823%
La *	0.045%	0.014%
Li	0.020%	0.011%
Mg	1.145%	1.494%
Mn	0.074%	0.101%
Mo	-0.008%	-0.008%
Na	9.036%	
Nd *	0.238%	0.087%
Ni		0.030%
P	0.187%	0.180%
Pb	0.211%	-0.065%
S	0.086%	-0.065%
Si	18.734%	24.378%
Sn	-0.064%	-0.065%
Sr	-0.002%	-0.002%
Te	-0.008%	-0.008%
Ti	0.554%	0.945%
V	-0.008%	-0.008%
Y	-0.002%	-0.002%
Zn	-0.008%	-0.008%
Zr	0.030%	

Oxide	Wt % Oxide	Wt % Oxide	Average Wt % Oxide	Percent Deviation Oxide	
Ag2O	-0.004%	-0.004%	0.00%	-1%	
Al2O3	7.974%	11.022%	9.50%	-32%	Lo
B2O3	0.159%	0.057%	0.11%	94%	
BaO	-0.003%	0.074%	0.04%	-215%	
BeO	-0.007%	-0.007%	-0.01%	-1%	
Bi2O3	0.104%	-0.054%	0.03%	632%	
CaO	3.786%	5.139%	3.79%		Lo
CdO	-0.005%	-0.006%	-0.01%	-1%	
CeO2	0.237%	-0.040%	0.10%	280%	
Co2O3	-0.011%	-0.011%	-0.01%	-1%	
Cr2O3	-0.023%	-0.024%	-0.02%	-1%	
CuO	-0.006%	-0.006%	-0.01%	-1%	
Dy2O3	-0.005%	-0.006%	-0.01%	-1%	
Eu2O3	-0.004%	-0.004%	0.00%	-1%	
Fe2O3	5.460%	8.337%	6.90%	-42%	Lo
K2O		2.195%	2.20%		OK
La2O3	0.053%	0.017%	0.03%	105%	
Li2O	0.044%	0.024%	0.03%	57%	
MgO	1.900%	2.478%	2.19%	-26%	OK
MnO	0.117%	0.159%	0.14%	-31%	
MoO3	-0.012%	-0.012%	-0.01%	-1%	
Na2O	12.180%		12.18%		Hi
Nd2O3	0.277%	0.101%	0.19%	93%	
NiO		0.038%	0.04%		
P2O5	0.428%	0.413%	0.42%	4%	
PbO	0.228%	-0.070%	0.08%	376%	
SO3	0.216%	-0.161%	0.03%	1387%	
SiO2	40.075%	52.149%	46.11%	-26%	Lo
SnO2	-0.081%	-0.082%	-0.08%	-1%	
SrO	-0.003%	-0.003%	0.00%	-1%	
TeO2	-0.010%	-0.010%	-0.01%	-1%	
TiO2	0.924%	1.576%	1.25%	-52%	Lo
VO2	-0.013%	-0.013%	-0.01%	-1%	
Y2O3	-0.003%	-0.003%	0.00%	-1%	
ZnO	-0.010%	-0.010%	-0.01%	-1%	
ZrO2	0.040%		0.04%		

9.0	Sub-total =	41.44%		44.48%	Sub-total =	74.202%		82.426%	
	K =	1.823%	a	9.036%	K2O =	2.195%	a2O =	12.180%	
	Ni =	0.030%	Zr	0.030%	NiO =	0.038%	ZrO2 =	0.040%	
10.0	Total =	43.29%		53.55%	Total =	76.4%		94.6%	85.5%

11.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na2O2 fusion is performed in zirconium metal crucible. Thus the Zr and Na reported are values obtained from the KOH/Ni fusion.

12.0 Comment: At low concentration of Ca, the Na2O2 fusion is not included in the average value.
Negative values reported in this procedure are at or below the estimated detection limit for the ICP/AES procedure.

12.0 Calculated by and date

13.0 Approved by and date

* suspect numbers

ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0	Lab No	1419-93	
2.0	Customer	Merrill	
3.0	Customer's Sample ID	SF-1	600 Area SF Surrogate
4.0	Fusion Method	KOH	Na2O2
5.0	Sample Wt	0.3132	0.3096
6.0	Dilution	2500	2500

7.0 ICP Analysis

The fusions were performed by the Analytical and Support Laboratory.

The solutions from the fused samples ware analyzed on the ICP at 324 Building.

Element	Element Conc (ug/mL)	KOH Wt % Element	Element Conc (ug/mL)	Na2O2 Wt% Element	Oxide	Conversion Factor	KOH Wt% Oxide	Na2O2 Wt% Oxide
Ag		-0.004%		-0.004%	AgO	1.07428	-0.004%	-0.004%
Al	5.287	4.220%	7.224	5.833%	Al2O3	1.88955	7.974%	11.022%
B	0.0618	0.049%	0.022	0.018%	B2O3	3.22017	0.159%	0.057%
Ba		-0.002%	0.0816	0.066%	BaO	1.1165	-0.003%	0.074%
Be		-0.002%		-0.002%	BeO	2.77519	-0.007%	-0.007%
Bi	0.1169	0.093%		-0.048%	Bi2O3	1.11484	0.104%	-0.054%
Ca	3.39	2.706%	4.548	3.672%	CaO	1.3992	3.786%	5.139%
Cd		-0.005%		-0.005%	CdO	1.14235	-0.005%	-0.006%
Ce	0.2418	0.193%		-0.032%	CeO2	1.22845	0.237%	-0.040%
Co		-0.008%		-0.008%	Co2O3	1.40726	-0.011%	-0.011%
Cr		-0.016%		-0.016%	Cr2O3	1.46184	-0.023%	-0.024%
Cu		-0.005%		-0.005%	CuO	1.25169	-0.006%	-0.006%
Dy		-0.005%		-0.005%	Dy2O3	1.14769	-0.005%	-0.006%
Eu		-0.003%		-0.003%	Eu2O3	1.15794	-0.004%	-0.004%
Fe	4.785	3.819%	7.222	5.832%	Fe2O3	1.42963	5.460%	8.337%
K	352.4		2.257	1.823%	K2O	1.2046		2.195%
La	0.0569	0.045%	0.0176	0.014%	La2O3	1.17277	0.053%	0.017%
Li	0.0254	0.020%	0.0139	0.011%	Li2O	2.15274	0.044%	0.024%
Mg	1.435	1.145%	1.85	1.494%	MgO	1.65858	1.900%	2.478%
Mn	0.0926	0.074%	0.1246	0.101%	MnO	1.58245	0.117%	0.159%
Mo		-0.008%		-0.008%	MoO3	1.50042	-0.012%	-0.012%
Na	11.32	9.036%	378.9		Na2O	1.34798	12.180%	
Nd	0.2978	0.238%	0.1075	0.087%	Nd2O3	1.16639	0.277%	0.101%
Ni	0.7072		0.0369	0.030%	NiO	1.27253		0.038%
P	0.2338	0.187%	0.223	0.180%	P2O5	2.29128	0.428%	0.413%
Pb	0.2648	0.211%		-0.065%	PbO	1.0777	0.228%	-0.070%
S	0.1082	0.086%	0.0427	-0.065%	SO3	2.49673	0.216%	-0.161%
Si	23.47	18.734%	30.19	24.378%	SiO2	2.13914	40.075%	52.149%
Sn		-0.064%		-0.065%	SnO2	1.26961	-0.081%	-0.082%
Sr		-0.002%		-0.002%	SrO	1.18272	-0.003%	-0.003%
Te		-0.008%		-0.008%	TeO2	1.25078	-0.010%	-0.010%
Ti	0.6943	0.554%	1.17	0.945%	TiO2	1.66806	0.924%	1.576%
V		-0.008%		-0.008%	VO2	1.62819	-0.013%	-0.013%
Y		-0.002%		-0.002%	Y2O3	1.26988	-0.003%	-0.003%
Zn		-0.008%		-0.008%	ZnO	1.24476	-0.010%	-0.010%
Zr	0.0372	0.030%	8.174		ZrO2	1.3508	0.040%	
8.0	Sub-total =	41.44%		44.48%	Sub-total =		74.202%	83.778%
	Plus K =	1.823%	Plus Na =	9.036%	Plus K2O		2.195%	Plus Na2O2 12.180%
	Plus Ni =	0.030%	Plus Zr =	0.030%	Plus NiO		0.038%	Plus ZrO2 0.040%
9.0	Total =	43.29%	0	53.55%	Total =		76.435%	95.998%

10.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na and Zr reported on the Na2O2/Zr crucible are values obtained from the KOH/Ni fusion.

9H3276.0801

Analysis Report Fri 09-03-93 11:25:12 AM page 1

600 Area SF Surrogate

Method: GEN Sample Name: SF-1 1448.93 Operator: kfw
Run Time: 09/03/93 11:23:32
Comment: KOH .3132 2500
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0376	5.287	.0618	.0675	.0017	.1169	3.390
SDev	.0003	.039	.0010	.0026	.0000	.0067	.036
%RSD	.9294	.7367	1.693	3.784	.0339	5.758	1.050
#1	.0379	5.256	.0612	.0646	.0017	.1198	3.356
#2	.0372	5.274	.0630	.0687	.0017	.1092	3.386
#3	.0375	5.330	.0612	.0693	.0017	.1217	3.427

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0110	.2418	.0359	.0408	.0181	.0315	.0089
SDev	.0003	.0005	.0002	.0008	.0000	.0002	.0001
%RSD	3.062	.2250	.4432	1.953	.0000	.5751	.9676
#1	.0107	.2419	.0360	.0414	.0181	.0313	.0089
#2	.0113	.2424	.0360	.0411	.0181	.0316	.0090
#3	.0110	.2413	.0358	.0399	.0181	.0316	.0089

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	4.785	352.4	.0569	.0254	1.435	.0926	.0306
SDev	.042	3.2	.0008	.0021	.011	.0008	.0008
%RSD	.8830	.9184	1.342	8.087	.7541	.8759	2.703
#1	4.743	349.1	.0577	.0231	1.425	.0918	.0313
#2	4.783	352.4	.0562	.0268	1.435	.0925	.0297
#3	4.828	355.6	.0569	.0265	1.446	.0934	.0307

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	8.367	11.32	.2978	.7072	.2338	.2648	.1082
SDev	.096	.17	.0022	.0024	.0192	.0043	.0052
%RSD	1.151	1.534	.7317	.3419	8.224	1.605	4.774
#1	8.340	11.36	.2998	.7061	.2159	.2599	.1029
#2	8.474	11.47	.2980	.7056	.2541	.2677	.1087
#3	8.287	11.13	.2955	.7100	.2314	.2668	.1132

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	23.47	.0812	.0304	.1258	.6943	.0483	-.0343
SDev	.20	.0011	.0003	.0070	.0065	.0002	.0008
%RSD	.8569	1.366	.8646	5.555	.9283	.3274	2.262
#1	23.28	.0809	.0301	.1273	.6882	.0481	-.0351
#2	23.46	.0824	.0305	.1181	.6937	.0484	-.0340
#3	23.68	.0802	.0306	.1319	.7010	.0484	-.0336

Elem	Zn2138	Zr3391
Avge	.0154	.0372
SDev	.0002	.0009
%RSD	1.090	2.435
#1	.0153	.0362
#2	.0156	.0376
#3	.0155	.0379

DW 3274.0802

Analysis Report Fri 09-03-93 11:13:42 AM page 1

600 Area SF Surrogate

Method: GEN Sample Name: SF-1 1448-93 Operator: kfw
Run Time: 09/03/93 11:12:02
Comment: NA2O2 .3096 2500
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	-.0209	7.224	.0220	.0816	.0062	.0385	4.548
SDev	.0016	.048	.0027	.0005	.0002	.0027	.018
%RSD	7.843	.6579	12.36	.5672	3.786	6.923	.3953
#1	-.0194	7.170	.0251	.0820	.0064	.0390	4.529
#2	-.0206	7.241	.0207	.0817	.0063	.0409	4.565
#3	-.0226	7.260	.0201	.0811	.0060	.0356	4.550

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0266	-.0282	.0087	.0228	-.0051	.0058	.0028
SDev	.0010	.0048	.0011	.0017	.0007	.0011	.0002
%RSD	3.654	16.88	12.09	7.505	13.64	18.90	6.186
#1	.0272	-.0242	.0094	.0243	-.0044	.0069	.0029
#2	.0272	-.0271	.0093	.0231	-.0051	.0057	.0029
#3	.0255	-.0335	.0075	.0209	-.0058	.0048	.0026

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	7.222	2.257	.0176	.0139	1.850	.1246	.0116
SDev	.035	.293	.0019	.0017	.005	.0009	.0006
%RSD	.4906	12.97	10.97	12.24	.2527	.7353	5.403
#1	7.181	2.548	.0191	.0157	1.845	.1236	.0109
#2	7.242	2.262	.0182	.0138	1.854	.1253	.0117
#3	7.243	1.962	.0154	.0123	1.851	.1249	.0121

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	378.9	341.3	.1075	.0369	.2330	.0751	.0427
SDev	2.6	1.7	.0066	.0028	.0103	.0062	.0073
%RSD	.6788	.4866	6.123	7.519	4.428	8.196	16.99
#1	376.4	339.4	.1140	.0388	.2438	.0786	.0474
#2	378.7	342.5	.1077	.0381	.2321	.0787	.0464
#3	381.5	341.9	.1009	.0337	.2232	.0680	.0344

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	30.19	.0667	.0462	.0511	1.170	.0342	-.0349
SDev	.14	.0029	.0004	.0088	.008	.0009	.0003
%RSD	.4591	4.337	.7758	17.17	.6495	2.561	.8132
#1	30.03	.0669	.0458	.0578	1.161	.0345	-.0346
#2	30.26	.0695	.0463	.0412	1.174	.0348	-.0350
#3	30.28	.0638	.0465	.0544	1.175	.0332	-.0351

Elem	Zn2138	Zr3391
Avge	.0171	8.174
SDev	.0002	.048
%RSD	.9124	.5846
#1	.0173	8.119
#2	.0171	8.198
#3	.0170	8.205

9411276.0803

ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0 ICP Analysis

The solutions from the fused samples were analyzed on the ICP at 324 Building

2.0	Lab No	1419-93			1419-93	
3.0	Customer	Merrill			Merrill	
4.0	Customer's ID	SF-2	600 Area SF Surrogate		SF-2	
5.0	Fusion Method	KOH	Na2O2		KOH	Na2O2
6.0	Sample Wt	0.3096 g	0.3126 g		0.3096 g	0.3126 g
7.0	Dilution	2500 mL	2500 mL		2500 mL	2500 mL

8.0 Analysis

Element	Wt % Element	Wt % Element	Oxide	Wt % Oxide	Wt % Oxide	Average Wt % Oxide	Percent Deviation Oxide	
Ag	-0.004%	-0.004%	Ag2O	-0.004%	-0.004%	0.00%	1%	
Al	6.031%	6.656%	Al2O3	11.396%	12.577% OK	11.99%	-10%	Lo
B	0.053%	0.010%	B2O3	0.171%	0.034%	0.10%	134%	
Ba	-0.002%	-0.002%	BaO	-0.003%	-0.003%	0.00%	1%	
Be	-0.002%	-0.002%	BeO	-0.007%	-0.007%	-0.01%	1%	
Bi *	0.172%	-0.048%	Bi2O3	0.191%	-0.053%	0.07%	355%	
Ca	3.245%	4.215%	CaO	4.541%	5.897% OK	4.54%		Lo
Cd	-0.005%	-0.005%	CdO	-0.006%	-0.005%	-0.01%	1%	
Ce *	0.323%	-0.032%	CeO2	0.397%	-0.039%	0.18%	244%	
Co	-0.008%	-0.008%	Co2O3	-0.011%	-0.011%	-0.01%	1%	
Cr	-0.016%	-0.016%	Cr2O3	-0.024%	-0.023%	-0.02%	1%	
Cu	-0.005%	-0.005%	CuO	-0.006%	-0.006%	-0.01%	1%	
Dy	-0.005%	-0.005%	Dy2O3	-0.006%	-0.006%	-0.01%	1%	
Eu	-0.003%	-0.003%	Eu2O3	-0.004%	-0.004%	0.00%	1%	
Fe	5.161%	6.563%	Fe2O3	7.379%	9.382% OK	8.38%	-24%	OK
K		2.984%	K2O		3.594% Hi	3.59%		Hi
La	0.079%	0.016%	La2O3	0.092%	0.018%	0.06%	133%	
Li	0.033%	0.006%	Li2O	0.070%	0.014%	0.04%	135%	
Mg	1.457%	1.672%	MgO	2.416%	2.774% OK	2.59%	-14%	OK
Mn	0.088%	0.111%	MnO	0.139%	0.176%	0.16%	-23%	
Mo	-0.008%	-0.008%	MoO3	-0.012%	-0.012%	-0.01%	1%	
Na	5.245%		Na2O	7.070%	—	7.07%		Hi
Nd	0.399%	0.111%	Nd2O3	0.466%	0.129%	0.30%	113%	
Ni		0.034%	NiO		0.043%	0.04%		
P	0.251%	0.219%	P2O5	0.576%	0.501%	0.54%	14%	
Pb	0.275%	0.077%	PbO	0.296%	0.084%	0.19%	112%	
S	0.141%	-0.064%	SO3	0.351%	-0.160%	0.10%	534%	
Si	24.483%	27.935%	SiO2	52.373%	59.757% OK	56.07%	-13%	Lo
Sn	0.101%	-0.064%	SnO2	0.128%	-0.081%	0.02%	894%	
Sr	-0.002%	-0.002%	SrO	-0.003%	-0.003%	0.00%	1%	
Te *	0.163%	0.052%	TeO2	0.204%	0.065%	0.13%	103%	
Ti	0.795%	1.069%	TiO2	1.326%	1.784% OK	1.55%	-29%	OK
V	-0.008%	-0.008%	VO2	-0.013%	-0.013%	-0.01%	1%	
Y	-0.002%	-0.002%	Y2O3	-0.003%	-0.003%	0.00%	1%	
Zn	-0.008%	-0.008%	ZnO	-0.010%	-0.010%	-0.01%	1%	
Zr	0.046%		ZrO2	0.062%		0.06%		

9.0	Sub-total =	48.54%		51.73%	Sub-total =	89.644%		95.472%	
	K =	2.984%	a	5.245%	K2O =	3.594%	a2O =	7.070%	
	Ni =	0.034%	Zr	0.046%	NiO =	0.043%	ZrO2 =	0.062%	
10.0	Total =	51.56%		57.02%	Total =	93.3%		102.6%	97.9%

11.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na2O2 fusion is performed in zirconium metal crucible. Thus the Zr and Na reported are values obtained from the KOH/Ni fusion.

12.0 Comment: At low concentration of Ca, the Na2O2 fusion is not included in the average value.
Negative values reported in this procedure are at or below the estimated detection limit for the ICP/AES procedure.

12.0 Calculated by and date

13.0 Approved by and date

* suspect

ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0	Lab No	1419-93	
2.0	Customer	Merrill	
3.0	Customer's Sample ID	SF-2	600 Area SF Surrogate
4.0	Fusion Method	KOH	Na2O2
5.0	Sample Wt	0.3096	0.3126
6.0	Dilution	2500	2500

7.0 ICP Analysis

The fusions were performed by the Analytical and Support Laboratory.

The solutions from the fused samples were analyzed on the ICP at 324 Building.

Element	Element Conc (ug/mL)	KOH Wt % Element	Element Conc (ug/mL)	Na2O2 Wt% Element	Oxide	Conversion Factor	KOH Wt% Oxide		Na2O2 Wt% Oxide
Ag		-0.004%		-0.004%	AgO	1.07428	-0.004%		-0.004%
Al	7.469	6.031%	8.323	6.656%	Al2O3	1.88955	11.396%		12.577%
B	0.0659	0.053%	0.0131	0.010%	B2O3	3.22017	0.171%		0.034%
Ba		-0.002%		-0.002%	BaO	1.1165	-0.003%		-0.003%
Be		-0.002%		-0.002%	BeO	2.77519	-0.007%		-0.007%
Bi	0.2125	0.172%	0.0582	-0.048%	Bi2O3	1.11484	0.191%		-0.053%
Ca	4.019	3.245%	5.27	4.215%	CaO	1.3992	4.541%		5.897%
Cd		-0.005%		-0.005%	CdO	1.14235	-0.006%		-0.005%
Ce	0.3998	0.323%		-0.032%	CeO2	1.22845	0.397%		-0.039%
Co		-0.008%		-0.008%	Co2O3	1.40726	-0.011%		-0.011%
Cr		-0.016%		-0.016%	Cr2O3	1.46184	-0.024%		-0.023%
Cu		-0.005%		-0.005%	CuO	1.25169	-0.006%		-0.006%
Dy		-0.005%		-0.005%	Dy2O3	1.14769	-0.006%		-0.006%
Eu		-0.003%		-0.003%	Eu2O3	1.15794	-0.004%		-0.004%
Fe	6.392	5.161%	8.206	6.563%	Fe2O3	1.42963	7.379%		9.382%
K	380.3		3.731	2.984%	K2O	1.2046			3.594%
La	0.0973	0.079%	0.0197	0.016%	La2O3	1.17277	0.092%		0.018%
Li	0.0404	0.033%	0.0079	0.006%	Li2O	2.15274	0.070%		0.014%
Mg	1.804	1.457%	2.091	1.672%	MgO	1.65858	2.416%		2.774%
Mn	0.1088	0.088%	0.1388	0.111%	MnO	1.58245	0.139%		0.176%
Mo		-0.008%		-0.008%	MoO3	1.50042	-0.012%		-0.012%
Na	6.495	5.245%	419.5		Na2O	1.34798	7.070%		
Nd	0.4944	0.399%	0.1388	0.111%	Nd2O3	1.16639	0.466%		0.129%
Ni	0.818		0.0421	0.034%	NiO	1.27253			0.043%
P	0.3111	0.251%	0.2733	0.219%	P2O5	2.29128	0.576%		0.501%
Pb	0.3403	0.275%	0.0969	0.077%	PbO	1.0777	0.296%		0.084%
S	0.1742	0.141%	0.0539	-0.064%	SO3	2.49673	0.351%		-0.160%
Si	30.32	24.483%	34.93	27.935%	SiO2	2.13914	52.373%		59.757%
Sn	0.1249	0.101%		-0.064%	SnO2	1.26961	0.128%		-0.081%
Sr		-0.002%		-0.002%	SrO	1.18272	-0.003%		-0.003%
Te	0.2016	0.163%	0.0651	0.052%	TeO2	1.25078	0.204%		0.065%
Ti	0.9844	0.795%	1.337	1.069%	TiO2	1.66806	1.326%		1.784%
V		-0.008%		-0.008%	VO2	1.62819	-0.013%		-0.013%
Y		-0.002%		-0.002%	Y2O3	1.26988	-0.003%		-0.003%
Zn		-0.008%		-0.008%	ZnO	1.24476	-0.010%		-0.010%
Zr	0.0571	0.046%	9.112		ZrO2	1.3508	0.062%		
8.0	Sub-total =	48.54%		51.73%	Sub-total =		89.644%		96.829%
	Plus K =	2.984%	Plus Na =	5.245%	Plus K2O		3.594%	Plus Na2O2	7.070%
	Plus Ni =	0.034%	Plus Zr =	0.046%	Plus NiO		0.043%	Plus ZrO2	0.062%
9.0	Total =	51.56%	0	57.02%	Total =		93.281%		103.961%

10.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na and Zr reported on the Na2O2/Zr crucible are values obtained from the KOH/Ni fusion.

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660 Area SF Surrogate

Method: GEN Sample Name: SF-2 1449-93 Operator: kfw
Run Time: 09/03/93 11:16:23
Comment: NA2O2 .3126 2500
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	-.0181	8.323	.0131	.0891	.0018	.0582	5.270
SDev	.0004	.036	.0021	.0002	.0001	.0045	.023
%RSD	2.472	.4334	15.95	.1964	5.056	7.784	.4363
#1	-.0185	8.333	.0109	.0893	.0019	.0556	5.279
#2	-.0176	8.283	.0134	.0890	.0019	.0556	5.244
#3	-.0180	8.353	.0151	.0890	.0017	.0635	5.287

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0064	.0048	.0140	.0231	-.0013	.0101	.0036
SDev	.0007	.0035	.0007	.0004	.0003	.0005	.0001
%RSD	10.96	74.16	4.952	1.929	27.27	4.673	4.110
#1	.0070	.0016	.0132	.0227	-.0016	.0097	.0035
#2	.0066	.0085	.0145	.0236	-.0009	.0107	.0038
#3	.0056	.0041	.0143	.0229	-.0013	.0100	.0036

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	8.206	3.731	.0197	.0079	2.091	.1388	.0164
SDev	.034	.074	.0006	.0003	.012	.0007	.0013
%RSD	.4137	1.994	2.860	3.896	.5505	.5233	8.171
#1	8.219	3.652	.0190	.0082	2.087	.1389	.0162
#2	8.167	3.799	.0198	.0079	2.083	.1381	.0178
#3	8.232	3.742	.0201	.0076	2.105	.1395	.0152

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	419.5	378.3	.1388	.0421	.2733	.0969	.0539
SDev	1.3	1.3	.0047	.0013	.0112	.0075	.0025
%RSD	.3098	.3455	3.415	3.118	4.116	7.729	4.646
#1	420.4	378.8	.1346	.0436	.2646	.0928	.0563
#2	418.0	376.8	.1439	.0411	.2692	.1056	.0513
#3	420.1	379.3	.1379	.0417	.2860	.0924	.0541

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	34.93	.0799	.0519	.0651	1.337	.0426	-.0371
SDev	.15	.0019	.0002	.0135	.007	.0006	.0002
%RSD	.4415	2.404	.3832	20.72	.5069	1.333	.4240
#1	34.99	.0821	.0520	.0675	1.340	.0422	-.0373
#2	34.76	.0789	.0516	.0505	1.329	.0424	-.0370
#3	35.05	.0786	.0520	.0772	1.342	.0432	-.0370

Elem	Zn2138	Zr3391
Avge	.0152	9.112
SDev	.0003	.035
%RSD	1.858	.3831
#1	.0149	9.122
#2	.0155	9.074
#3	.0152	9.142

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Analysis Report Fri 09-03-93 11:47:17 AM page 1

600 Area SF Surrogate

Method: GEN Sample Name: SF-2 1449-93 Operator: kfw
Run Time: 09/03/93 11:45:37
Comment: KOH .3096 2500
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0625	7.469	.0659	.0886	.0028	.2125	4.019
SDev	.0015	.046	.0015	.0004	.0001	.0071	.022
%RSD	2.328	.6208	2.335	.4612	3.152	3.325	.5420
#1	.0619	7.468	.0675	.0885	.0027	.2141	4.018
#2	.0642	7.424	.0657	.0882	.0029	.2187	3.998
#3	.0615	7.516	.0645	.0890	.0027	.2048	4.041

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0166	.3998	.0620	.0663	.0398	.0518	.0148
SDev	.0005	.0106	.0017	.0014	.0014	.0011	.0003
%RSD	2.865	2.660	2.803	2.099	3.442	2.067	2.103
#1	.0170	.3942	.0605	.0651	.0392	.0512	.0146
#2	.0167	.4121	.0639	.0678	.0414	.0530	.0152
#3	.0161	.3931	.0615	.0660	.0389	.0512	.0147

GW-3276.0807

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	6.392	380.3	.0973	.0404	1.804	.1088	.0533
SDev	.039	2.5	.0020	.0004	.007	.0006	.0005
%RSD	.6160	.6568	2.097	1.107	.3702	.5685	1.013
#1	6.402	380.7	.0963	.0402	1.796	.1086	.0531
#2	6.348	377.6	.0997	.0409	1.809	.1083	.0540
#3	6.425	382.5	.0959	.0402	1.805	.1095	.0529

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	6.495	18.03	.4944	.8180	.3111	.3403	.1742
SDev	.208	.34	.0116	.0062	.0133	.0077	.0019
%RSD	3.209	1.888	2.352	.7612	4.279	2.266	1.066
#1	6.373	17.87	.4883	.8141	.2972	.3359	.1762
#2	6.735	18.42	.5078	.8148	.3237	.3492	.1726
#3	6.376	17.79	.4871	.8252	.3124	.3358	.1739

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	30.32	.1249	.0446	.2016	.9844	.0766	-.0321
SDev	.19	.0012	.0003	.0030	.0067	.0010	.0003
%RSD	.6242	.9558	.6102	1.490	.6844	1.344	.7921
#1	30.33	.1250	.0446	.2043	.9853	.0761	-.0322
#2	30.12	.1237	.0444	.2021	.9773	.0778	-.0318
#3	30.50	.1261	.0449	.1983	.9907	.0758	-.0322

Elem	Zn2138	Zr3391
Avge	.0226	.0571
SDev	.0002	.0005
%RSD	.8575	.9404
#1	.0224	.0568
#2	.0225	.0577
#3	.0228	.0568

ICP RESULTS FOR 100 AREA SOIL FINES

Oxide	100 Area Soil Fines KOH	100 Area Soil Fines Na2O2	Corrected 100 Area Soil Fines Na2O2	Corrected 100 Area Soil Fines KOH	Oxide	Average wt%	Oxide	Average wt%
Si	66.89	73.19	66.01	66.33	Si	66.17	Si	66.17
Al	13.26	14.28	12.88	13.14	Al	13.01	Al	13.01
Fe	5.77	6.78	6.12	5.72	Fe	5.92	Fe	5.92
Ca	3.79	4.15	3.75	3.76	Ca	3.75	Ca	3.75
Na	3.61		3.61	3.58	Na	3.59	Na	3.59
K		3.80	3.43	3.43	K	3.43	K	3.43
Mg	1.95	2.30	2.07	1.94	Mg	2.01	Mg	2.01
Ti	1.01	1.09	0.99	1.00	Ti	0.99	Ti	0.99
P	0.33	0.35	0.32	0.32	P	0.32	other	1.12
Ba	0.14	0.11	0.10	0.14	Ba	0.12		
Mn	0.11	0.13	0.12	0.11	Mn	0.12		
Pb	0.11	0.08	0.07	0.11	Pb	0.09		
Zr	0.07		0.07	0.07	Zr	0.07		
Nd	0.06	0.12	0.11	0.06	Nd	0.08		
Sr	0.05	0.05	0.05	0.05	Sr	0.05		
Ce	0.04	0.08	0.07	0.04	Ce	0.06		
Te	0.04	0.06	0.06	0.04	Te	0.05		
V	0.03	0.04	0.04	0.03	V	0.03		
Zn	0.02	0.03	0.02	0.02	Zn	0.02		
La	0.02	0.02	0.02	0.02	La	0.02		
Mo	0.02	0.02	0.02	0.01	Mo	0.02		
Cu	0.01	0.01	0.01	0.01	Cu	0.01		
Co	0.01	0.02	0.01	0.01	Co	0.01		
Li	0.01	0.01	0.01	0.01	Li	0.01		
Y	0.00	0.01	0.01	0.00	Y	0.00		
Ni		0.04	0.04	0.04	Ni	0.04		
total	97.3	106.8	100.0	100.0	total	100.0	total	100.0

Worksheet 11/8/93
RA Merrill

100 Area Soil Fines - Fusion

ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0 ICP Analysis

The solutions from the fused samples were analyzed on the ICP at 324 Building

2.0	Lab No	0			0	
3.0	Customer	RICK MERRILL			RICK MERRILL	
4.0	Customer's ID	SOIL	100 Area Soil Fines		SOIL	
5.0	Fusion Method	KOH	Na2O2		KOH	Na2O2
6.0	Sample Wt	0.324 g	0.292 g		0.324 g	0.292 g
7.0	Dilution	2524 mL	2500 mL		2524 mL	2500 mL

8.0 Analysis

Element	Wt % Element	Wt % Element	Oxide	Wt % Oxide	Wt % Oxide	Average Wt % Oxide	Percent Deviation Oxide
Ag	0.004%	-0.004%	Ag2O	0.005%	-0.005%	0.00%	-22891%
Al	7.015%	7.559%	Al2O3	13.255%	14.283%	13.77%	-7%
B	0.017%	-0.009%	B2O3	0.056%	-0.028%	0.01%	592%
Ba	0.124%	0.096%	BaO	0.138%	0.107%	0.12%	25%
Be	-0.002%	-0.003%	BeO	-0.006%	-0.007%	-0.01%	-9%
Bi	-0.047%	-0.051%	Bi2O3	-0.052%	-0.057%	-0.05%	-9%
Ca	2.709%	2.968%	CaO	3.791%	4.153%	3.79%	
Cd	-0.005%	-0.005%	CdO	-0.005%	-0.006%	-0.01%	-9%
Ce	0.033%	0.067%	CeO2	0.041%	0.083%	0.06%	-68%
Co	0.008%	0.011%	Co2O3	0.012%	0.016%	0.01%	-28%
Cr	-0.016%	0.028%	Cr2O3	-0.023%	0.040%	0.01%	-716%
Cu	0.011%	0.011%	CuO	0.014%	0.014%	0.01%	1%
Dy	-0.005%	0.008%	Dy2O3	-0.005%	0.009%	0.00%	-800%
Eu	-0.003%	-0.003%	Eu2O3	-0.004%	-0.004%	0.00%	-9%
Fe	4.034%	4.745%	Fe2O3	5.767%	6.783%	6.28%	-16%
K		3.158%	K2O		3.804%	3.80%	
La	0.014%	0.018%	La2O3	0.016%	0.021%	0.02%	-27%
Li	0.004%	0.006%	Li2O	0.010%	0.014%	0.01%	-36%
Mg	1.178%	1.387%	MgO	1.954%	2.300%	2.13%	-16%
Mn	0.072%	0.083%	MnO	0.114%	0.132%	0.12%	-15%
Mo	0.010%	0.013%	MoO3	0.015%	0.020%	0.02%	-28%
Na	2.677%		Na2O	3.608%		3.61%	
Nd	0.054%	0.102%	Nd2O3	0.063%	0.119%	0.09%	-62%
Ni		0.033%	NiO		0.042%	0.04%	
P	0.142%	0.154%	P2O5	0.325%	0.353%	0.34%	-8%
Pb	0.099%	0.075%	PbO	0.107%	0.081%	0.09%	28%
S	-0.062%	-0.068%	SO3	-0.156%	-0.171%	-0.16%	-9%
Si	31.270%	34.212%	SiO2	66.890%	73.185%	70.04%	-9%
Sn	-0.062%	-0.068%	SnO2	-0.079%	-0.087%	-0.08%	-9%
Sr	0.039%	0.044%	SrO	0.046%	0.052%	0.05%	-11%
Te	0.033%	0.051%	TeO2	0.041%	0.064%	0.05%	-44%
Ti	0.602%	0.656%	TiO2	1.005%	1.093%	1.05%	-8%
V	0.017%	0.026%	VO2	0.028%	0.042%	0.03%	-40%
Y	0.003%	0.005%	Y2O3	0.004%	0.006%	0.01%	-40%
Zn	0.019%	0.020%	ZnO	0.024%	0.025%	0.02%	-4%
Zr	0.053%		other ZrO2	0.072%		0.07%	
9.0 Sub-total =	50.24%	55.54%	Sub-total =	97.389%	106.479%		
K=	3.158%	a 2.677%	K2O=	3.804%	a2O=	3.608%	
Ni=	0.033%	Zr 0.053%	NiO=	0.042%	ZrO2=	0.072%	
10.0 Total =	53.43%	58.27%	Total =	101.2%	110.2%	105.7%	

11.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na2O2 fusion is performed in zirconium metal crucible. Thus the Zr and Na reported are values obtained from the KOH/Ni fusion.

12.0 Comment: At low concentration of Ca, the Na2O2 fusion is not included in the average value.
Negative values reported in this procedure are at or below the estimated detection limit for the ICP/AES procedure.

12.0 Calculated by and date

13.0 Approved by and date

GW-3276-0809

ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0	Lab No	0	
2.0	Customer	RICK MERRILL	
3.0	Customer's Sample ID	SOIL	100 Area Soil Fines
4.0	Fusion Method	KOH	Na2O2
5.0	Sample Wt	0.3240	0.2920
6.0	Dilution	2624	2600

7.0 ICP Analysis

The fusions were performed by the Analytical and Support Laboratory.

The solutions from the fused samples were analyzed on the ICP at 324 Building.

Element	Element Conc (ug/mL)	KOH Wt % Element	Element Conc (ug/mL)	Na2O2 Wt% Element	Oxide	Conversion Factor	KOH Wt% Oxide		Na2O2 Wt% Oxide
Ag	0.0054	0.004%	0	-0.004%	AgO	1.07428	0.005%		-0.005%
Al	9.006	7.015%	8.829	7.559%	Al2O3	1.88955	13.255%		14.283%
B	0.0222	0.017%	0.0011	-0.009%	B2O3	3.22017	0.056%		-0.028%
Ba	0.159	0.124%	0.1123	0.096%	BaO	1.1165	0.138%		0.107%
Be	0	-0.002%	0.0013	-0.003%	BeO	2.77519	-0.006%		-0.007%
Bi	0.0276	-0.047%	0.0671	-0.051%	Bi2O3	1.11484	-0.052%		-0.057%
Ca	3.478	2.709%	3.467	2.968%	CaO	1.3992	3.791%		4.153%
Cd	0	-0.005%	0.0039	-0.005%	CdO	1.14235	-0.005%		-0.006%
Ce	0.0425	0.033%	0.0785	0.067%	CeO2	1.22845	0.041%		0.083%
Co	0.0106	0.008%	0.013	0.011%	Co2O3	1.40726	0.012%		0.016%
Cr	0.0156	-0.016%	0.0323	0.028%	Cr2O3	1.46184	-0.023%		0.040%
Cu	0.0145	0.011%	0.0131	0.011%	CuO	1.25189	0.014%		0.014%
Dy	0.0049	-0.005%	0.0091	0.008%	Dy2O3	1.14769	-0.005%		0.009%
Eu	0.0014	-0.003%	0.0037	-0.003%	Eu2O3	1.15794	-0.004%		-0.004%
Fe	5.178	4.034%	5.542	4.745%	Fe2O3	1.42963	5.767%		6.783%
K	357		3.688	3.158%	K2O	1.2046			3.804%
La	0.0175	0.014%	0.0208	0.018%	La2O3	1.17277	0.018%		0.021%
Li	0.0057	0.004%	0.0075	0.006%	Li2O	2.15274	0.010%		0.014%
Mg	1.512	1.178%	1.62	1.387%	MgO	1.65858	1.954%		2.300%
Mn	0.0921	0.072%	0.0973	0.083%	MnO	1.58245	0.114%		0.132%
Mo	0.013	0.010%	0.0157	0.013%	MoO3	1.50042	0.015%		0.020%
Na	3.436	2.677%	134		Na2O	1.34799	3.608%		
Nd	0.0694	0.054%	0.1196	0.102%	Nd2O3	1.16639	0.063%		0.119%
Ni	0.6496		0.039	0.033%	NiO	1.27253			0.042%
P	0.1819	0.142%	0.1797	0.154%	P2O5	2.29129	0.325%		0.353%
Pb	0.1277	0.099%	0.088	0.075%	PbO	1.0777	0.107%		0.081%
S	0.0758	-0.062%	0.0716	-0.063%	SO3	2.49673	-0.156%		-0.171%
Si	40.14	31.270%	39.96	34.212%	SiO2	2.13914	66.890%		73.185%
Sn	0.0326	-0.062%	0.0431	-0.068%	SnO2	1.26961	-0.079%		-0.087%
Sr	0.0504	0.039%	0.0512	0.044%	SrO	1.18272	0.046%		0.052%
Te	0.0419	0.033%	0.0596	0.051%	TeO2	1.25078	0.041%		0.064%
Ti	0.7734	0.602%	0.7651	0.655%	TiO2	1.66806	1.005%		1.093%
V	0.0221	0.017%	0.0301	0.026%	VO2	1.62819	0.028%		0.042%
Y	0.0041	0.003%	0.0056	0.005%	Y2O3	1.26988	0.004%		0.006%
Zn	0.0245	0.019%	0.0232	0.020%	ZnO	1.24476	0.024%		0.025%
Zr	0.0691	0.053%	13.48		ZrO2	1.3508	0.072%		
8.0	Sub-total =	50.24%		55.54%	Sub-total =		97.399%		106.841%
	Plus K =	3.158%	Plus Na =	2.677%	Plus K2O		3.804%	Plus Na2O	3.608%
	Plus Ni =	0.033%	Plus Zr =	0.053%	Plus NiO		0.042%	Plus ZrO2	0.072%
9.0	Total =	53.43%	0	58.27%	Total =		101.245%		110.521%

10.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na and Zr reported on the Na2O2/Zr crucible are values obtained from the KOH/Ni fusion.

EN-6276-5BD

Analysis Report Thu 09-16-93 02:35:03 PM page 1

Method: GEN Sample Name: 100 Area Soil Fines Soil R Merrill Operator: fth
Run Time: 09/16/93 14:33:37
Comment: 0.324g/252.4g 10 X Dil KOH
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0054	9.005	.0222	.1590	.0004	.0276	3.478
SDev	.0029	.015	.0019	.0005	.0001	.0037	.011
%RSD	53.96	.1689	8.768	.3421	18.29	13.58	.3096
#1	.0026	8.987	.0209	.1585	.0004	.0264	3.468
#2	.0051	9.012	.0245	.1591	.0004	.0246	3.477
#3	.0084	9.015	.0213	.1595	.0003	.0318	3.490

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0015	.0425	.0108	.0156	.0145	.0049	.0014
SDev	.0008	.0065	.0011	.0011	.0007	.0009	.0002
%RSD	56.29	15.20	9.859	7.202	4.917	19.21	16.37
#1	.0015	.0371	.0101	.0146	.0139	.0040	.0012
#2	.0006	.0408	.0103	.0153	.0143	.0049	.0015
#3	.0023	.0496	.0121	.0168	.0153	.0058	.0016

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	5.178	357.9	.0175	.0057	1.512	.0921	.0130
SDev	.005	.3	.0017	.0004	.009	.0003	.0006
%RSD	.1038	.0932	9.585	6.792	.6068	.2834	4.727
#1	5.174	357.8	.0157	.0052	1.502	.0918	.0123
#2	5.176	357.6	.0178	.0059	1.514	.0920	.0133
#3	5.184	358.2	.0190	.0059	1.520	.0923	.0135

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	3.436	1.610	.0694	.6496	.1319	.1277	.0758
SDev	.230	.367	.0058	.0020	.0069	.0090	.0007
%RSD	6.694	22.80	8.333	.3106	3.771	7.082	.9581
#1	3.234	1.190	.0669	.6498	.1891	.1202	.0750
#2	3.386	1.770	.0653	.6475	.1755	.1251	.0761
#3	3.686	1.870	.0760	.6515	.1811	.1377	.0763

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	40.14	.0326	.0504	.0419	.7734	.0221	.0041
SDev	.07	.0020	.0002	.0034	.0014	.0008	.0002
%RSD	.1738	5.994	.3275	8.163	.1821	3.571	4.676
#1	40.06	.0306	.0503	.0445	.7718	.0214	.0039
#2	40.15	.0330	.0504	.0380	.7746	.0220	.0040
#3	40.19	.0344	.0506	.0430	.7738	.0229	.0043

Elem	Zn2138	Zr3391
Avge	.0245	.0681
SDev	.0003	.0006
%RSD	1.210	.8113
#1	.0247	.0677
#2	.0242	.0679
#3	.0245	.0688

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Analysis Report Mon 09-13-93 12:41:20 PM page 1

Method: GEN Sample Name: Soil 100 Area Soil Fines Operator: FTH
Run Time: 09/13/93 12:39:39
Comment: Rick Merrill 0.292g/250 g 10 X Dil Na2O2
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	-.0341	8.829	.0011	.1123	.0013	.0571	3.467
SDev	.0020	.061	.0011	.0011	.0001	.0111	.017
%RSD	5.866	.6918	97.82	.9758	6.570	19.41	.5001
#1	-.0363	8.888	-.0001	.1135	.0012	.0466	3.485
#2	-.0337	8.832	.0020	.1121	.0012	.0560	3.465
#3	-.0324	8.766	.0015	.1114	.0014	.0686	3.450

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0039	.0785	.0130	.0323	.0131	.0091	.0037
SDev	.0005	.0144	.0013	.0018	.0008	.0012	.0005
%RSD	13.34	18.41	9.916	5.609	5.948	12.96	13.28
#1	.0036	.0628	.0117	.0303	.0125	.0078	.0032
#2	.0045	.0813	.0131	.0329	.0129	.0094	.0038
#3	.0036	.0912	.0142	.0338	.0140	.0100	.0041

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	5.542	3.688	.0208	.0075	1.620	.0973	.0157
SDev	.038	.297	.0026	.0014	.001	.0008	.0011
%RSD	.6948	8.046	12.33	18.46	.0525	.8050	7.202
#1	5.584	3.367	.0179	.0061	1.619	.0982	.0154
#2	5.533	3.746	.0217	.0075	1.619	.0970	.0169
#3	5.508	3.952	.0229	.0089	1.621	.0967	.0147

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	382.6	134.2	.1196	.0390	.1797	.0880	.0716
SDev	7.1	2.5	.0115	.0063	.0101	.0049	.0027
%RSD	1.862	1.861	9.612	16.31	5.596	5.507	3.822
#1	389.8	136.9	.1070	.0331	.1762	.0827	.0746
#2	382.4	133.9	.1223	.0381	.1719	.0892	.0713
#3	375.6	132.0	.1295	.0457	.1910	.0922	.0691

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	39.96	.0431	.0512	.0596	.7651	.0301	.0056
SDev	.24	.0028	.0008	.0115	.0051	.0010	.0003
%RSD	.6085	6.442	1.662	19.37	.6655	3.476	5.161
#1	40.21	.0412	.0521	.0496	.7706	.0289	.0052
#2	39.95	.0463	.0509	.0570	.7640	.0307	.0057
#3	39.73	.0418	.0505	.0723	.7606	.0307	.0058

Elem	Zn2138	Zr3391
Avge	.0232	13.48
SDev	.0001	.10
%RSD	.3648	.7243
#1	.0233	13.59
#2	.0233	13.46
#3	.0231	13.40

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ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0 ICP Analysis
The solutions from the fused samples were analyzed on the ICP at 324 Building

2.0	Lab No	0			0		
3.0	Customer	Rick Merrill			Rick Merrill		
4.0	Customer's ID	300 Area Soil FACS			300 Area Soil FACS		
5.0	Fusion Method	KOH	Na2O2		KOH	Na2O2	
6.0	Sample Wt	0.295 g	0.299 g		0.295 g	0.299 g	
7.0	Dilution	2500 mL	2500 mL		2500 mL	2500 mL	

8.0 Analysis

Element	Wt % Element	Wt % Element	Oxide	Wt % Oxide	Wt % Oxide	Average Wt % Oxide		Percent Deviation Oxide
Ag	-0.004%	-0.004%	Ag2O	-0.005%	-0.004%	0.00%		1%
Al	7.582%	7.809%	Al2O3	14.326%	14.755%	14.54%		-3%
B	-0.008%	-0.008%	B2O3	-0.027%	-0.027%	-0.03%		1%
Ba	0.128%	0.137%	BaO	0.144%	0.153%	0.15%		-6%
Be	-0.003%	-0.003%	BeO	-0.007%	-0.007%	-0.01%		1%
Bi	-0.051%	-0.050%	Bi2O3	-0.057%	-0.056%	-0.06%		1%
Ca	3.620%	3.846%	CaO	5.066%	5.381%	5.07%		
Cd	-0.005%	-0.005%	CdO	-0.006%	-0.006%	-0.01%		1%
Ce	-0.034%	-0.033%	CeO2	-0.042%	-0.041%	-0.04%		1%
Co	-0.008%	-0.008%	Co2O3	-0.012%	-0.012%	-0.01%		1%
Cr	0.017%	0.035%	Cr2O3	0.025%	0.052%	0.04%		-70%
Cu	0.059%	0.065%	CuO	0.073%	0.082%	0.08%		-11%
Dy	-0.005%	-0.005%	Dy2O3	-0.006%	-0.006%	-0.01%		1%
Eu	-0.003%	-0.003%	Eu2O3	-0.004%	-0.004%	0.00%		1%
Fe	5.410%	5.915%	Fe2O3	7.736%	8.456%	8.10%		-9%
K		1.520%	K2O		2.192%	2.19%		
La	0.009%	0.012%	La2O3	0.011%	0.014%	0.01%		-26%
Li	-0.004%	-0.004%	Li2O	-0.008%	-0.008%	-0.01%		1%
Mg	1.436%	1.532%	MgO	2.382%	2.541%	2.46%		-6%
Mn	0.088%	0.091%	MnO	0.139%	0.144%	0.14%		-4%
Mo	0.010%	0.011%	MoO3	0.014%	0.016%	0.02%		-11%
Na	0.829%		Na2O	1.118%		1.12%		
Nd	0.028%	0.045%	Nd2O3	0.033%	0.052%	0.04%		-46%
Ni		0.037%	NiO		0.047%	0.05%		
P	0.178%	0.211%	P2O5	0.407%	0.484%	0.45%		-17%
Pb	-0.068%	-0.067%	PbO	-0.073%	-0.072%	-0.07%		1%
S	-0.068%	-0.067%	SO3	-0.169%	-0.167%	-0.17%		1%
Si	29.308%	29.201%	SiO2	62.697%	62.468%	62.58%		0%
Sn	-0.068%	-0.067%	SnO2	-0.086%	-0.085%	-0.09%		1%
Sr	0.039%	0.046%	SrO	0.047%	0.054%	0.05%		-15%
Te	-0.051%	-0.050%	TeO2	-0.064%	-0.063%	-0.06%		1%
Ti	0.824%	0.866%	TiO2	1.391%	1.444%	1.42%		-4%
V	0.023%	0.028%	VO2	0.038%	0.045%	0.04%		-18%
Y	0.003%	0.004%	Y2O3	0.004%	0.005%	0.00%		-27%
Zn	0.052%	0.039%	ZnO	0.065%	0.048%	0.06%		30%
Zr	0.042%		ZrO2	0.057%		0.06%		

9.0	Sub-total =	48.79%		51.75%	Sub-total =	86.778%		88.118%	
	K =	1.520%	Na =	0.829%	K2O =	2.192%	Na2O =	1.118%	
	Ni =	0.037%	Zr =	0.042%	NiO =	0.047%	ZrO2 =	0.057%	
10.0	Total =	51.56%		52.62%	Total =	98.0%		99.3%	98.7%

11.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na2O2 fusion is performed in zirconium metal crucible. Thus the Zr and Na reported are values obtained from the KOH/Ni fusion.

12.0 Comment: At low concentration of Ca, the Na2O2 fusion is not included in the average value.
Negative values reported in this procedure are at or below the estimated detection limit for the ICP/AES procedure.

12.0 Calculated by and date

13.0 Approved by and date

9413276.0083

ICP ANALYSIS ON FUSED SAMPLES
Analytical and Process Support Laboratory

1.0	Lab No		
2.0	Customer	Rick Merrill	
3.0	Customer's Sample ID	300 Area Soil	Fines
4.0	Fusion Method	KOH	Na2O2
5.0	Sample Wt	0.2950	0.2990
6.0	Dilution	2500	2500

7.0 ICP Analysis

The fusions were performed by the Analytical and Support Laboratory.

The solutions from the fused samples were analyzed on the ICP at 324 Building.

Element	Detection Limit	Element Conc (ug/mL)	KOH Wt % Element	Element Conc (ug/mL)	Na2O2 Wt% Element	Oxide	Conversion Factor		KOH Wt% Oxide		Na2O2 Wt% Oxide
Ag	0.005	0.00448	-0.004%	-0.07067	-0.004%	AgO	1.0743	0.000%	-0.005%	0.000%	-0.004%
Al	0.03	9.94843	7.592%	9.3395	7.809%	Al2O3	1.8895	14.326%	14.326%	14.755%	14.755%
B	0.01	0.00467	-0.008%	-0.01717	-0.008%	B2O3	3.2202	0.000%	-0.027%	0.000%	-0.027%
Ba	0.003	0.15271	0.129%	0.1643	0.137%	BaO	1.1165	0.144%	0.144%	0.153%	0.153%
Be	0.003	0.00022	-0.003%	0.00163	-0.003%	BeO	2.7752	0.000%	-0.007%	0.000%	-0.007%
Bi	0.06	0.02282	-0.051%	0.03648	-0.050%	Bi2O3	1.1148	0.000%	-0.057%	0.000%	-0.056%
Ca	0.01	4.27172	2.620%	4.58837	3.848%	CaO	1.3992	5.065%	5.065%	5.381%	5.381%
Cd	0.006	0.00388	-0.005%	0.00261	-0.005%	CdO	1.1423	0.000%	-0.006%	0.000%	-0.006%
Ce	0.04	0.03177	-0.034%	-0.43311	-0.033%	CeO2	1.2284	0.000%	-0.042%	0.000%	-0.041%
Co	0.01	0.00606	-0.008%	0.00986	-0.008%	Co2O3	1.4073	0.000%	-0.012%	0.000%	-0.012%
Cr	0.02	0.02	0.017%	0.04223	0.035%	Cr2O3	1.4618	0.025%	0.025%	0.052%	0.052%
Cu	0.006	0.06915	0.059%	0.0781	0.065%	CuO	1.2517	0.073%	0.073%	0.082%	0.082%
Dy	0.006	0.00261	-0.005%	0.00406	-0.005%	Dy2O3	1.1477	0.000%	-0.006%	0.000%	-0.006%
Eu	0.004	0.00098	-0.003%	0.00226	-0.003%	Eu2O3	1.1579	0.000%	-0.004%	0.000%	-0.004%
Fe	0.006	6.38404	5.410%	7.07384	5.915%	Fe2O3	1.4296	7.735%	7.735%	8.456%	8.456%
K	0.3	444.0235		2.17872	1.820%	K2O	1.2046	0.000%		2.192%	2.192%
La	0.01	0.0106	0.009%	0.01411	0.012%	La2O3	1.1728	0.011%	0.011%	0.014%	0.014%
Li	0.005	0.00296	-0.004%	0.00262	-0.004%	Li2O	2.1527	0.000%	-0.009%	0.000%	-0.009%
Mg	0.06	1.98437	1.436%	1.83211	1.532%	MgO	1.6586	2.382%	2.382%	2.541%	2.541%
Mn	0.003	0.10339	0.088%	0.10817	0.091%	MnO	1.5822	0.139%	0.139%	0.144%	0.144%
Mo	0.01	0.01138	0.010%	0.01293	0.011%	MoO3	1.5004	0.014%	0.014%	0.016%	0.016%
Na	0.06	0.97851	0.529%	406.136		Na2O	1.348	1.118%	1.118%	0.000%	
		0.40624		413.3164							
Nd	0.02	0.03291	0.028%	0.0533	0.045%	Nd2O3	1.1664	0.033%	0.033%	0.052%	0.052%
Ni	0.02	1.04521		0.04481	0.037%	NiO	1.2725	0.000%		0.047%	0.047%
P	0.08	0.20961	0.178%	0.25298	0.211%	P2O5	2.2913	0.407%	0.407%	0.484%	0.484%
Pb	0.08	0.07884	-0.068%	0.08932	-0.067%	PbO	1.0777	0.000%	-0.073%	0.000%	-0.072%
S	0.08	0.03787	-0.068%	0.00729	-0.067%	SO3	2.4967	0.000%	-0.169%	0.000%	-0.167%
Si	0.01	34.58508	29.309%	34.92498	29.201%	SiO2	2.1391	62.697%	62.697%	62.466%	62.466%
Sn	0.08	0.04075	-0.068%	0.06771	-0.067%	SnO2	1.2696	0.000%	-0.086%	0.000%	-0.085%
Sr	0.003	0.04851	0.039%	0.05452	0.046%	SrO	1.1827	0.047%	0.047%	0.054%	0.054%
Te	0.06	0.03428	-0.051%	0.04391	-0.050%	TeO2	1.2508	0.000%	-0.064%	0.000%	-0.063%
Ti	0.003	0.99412	0.834%	1.0367	0.866%	TiO2	1.6681	1.391%	1.391%	1.444%	1.444%
V	0.01	0.02718	0.023%	0.03297	0.028%	VO2	1.6282	0.038%	0.038%	0.045%	0.045%
Y	0.003	0.00374	0.003%	0.00497	0.004%	Y2O3	1.2699	0.004%	0.004%	0.005%	0.005%
Zn	0.01	0.06227	0.053%	0.04842	0.039%	ZnO	1.2448	0.066%	0.066%	0.048%	0.048%
Zr	0.01	0.04982	0.042%	24.80488		ZrO2	1.3508	0.057%	0.057%	0.000%	
		1000		1000							
8.0		Sub-total =	49.70%		51.75%	Sub-total =		96.770%	96.770%	98.433%	98.433%
		Plus C =	1.820%	Plus N =	0.529%	Plus K2O			2.192%	Plus Na2O2	1.118%
		Plus Ni =	0.037%	Plus Zr =	0.042%	Plus NiO			0.047%	Plus ZrO2	0.057%
9.0		Total =	51.56%		52.62%	Total =			99.016%		99.608%

10.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na and Zr reported on the Na2O2/Zr crucible are values obtained from the KOH/Ni fusion.

DW 3776, 0011

Initial Isotopic Content of Soil Fines (pCi/g)			
100 Area Data from Shas Mattigod			
300 Area Data from Jeff Serne			
100 Area			
wt% in size	7.1	3.7	
	<0.074mm	.074< <.25mm	calc. <.25mm
Co-60	49	10	36
Cs-137	590	325	499
Eu-152	819	117	579
	<2mm		
Sr-90	12.5		
Pu-239/240	2.74		
300 Area	calc. <0.425 mm		
U-238	605	XRF Data	

DW 3276.0815

Uranium activity 1/7/94
RA Merrill

TCLP DATA SHEET

Date: 9-3-93
pH meter # _____ balance # _____ analyst(s): James Evans

Soil Fines Surrogates TCLP

Sample	Prelim. Eval. pH	Extraction Fluid	Wt. Extraction Bottle (g)	Wt. Sample (g)	Wt. Extraction Fluid (g)	Starting Date	Starting Time	Finishing Date	Finishing Time	Ambient Temp. (°C)	Extract pH	µL HNO3	Final pH
SF1		1	24.17g	5.01g	100.2g	9/7/93	14:00	9/8/93	08:25	24°C Indicative Only	4.98		
SF2		1	24.57g	5.00g	100.0g	9/7/93	14:00				4.98		
SF3	1.33	1	24.29g	4.99g	99.8g		14:32				4.99		
SF4		1	24.55g	5.02g	100.4g		14:33				4.97		
SF5	1.33	1	24.06g	5.02g	100.4g		14:35				4.98		
SF6		1	23.95g	5.01g	100.2g		14:36				4.98		
SF7		1	24.51g	5.02g	100.4g		14:37				5.00		
SF8		1	24.13g	5.00g	100.0g		14:38				4.98		
SF9-1		1	24.22g	5.02g	100.4g		14:39				4.98		
SF9-2		1	23.97	5.00g	100.0g		14:40				4.98		
SF9-3		1	24.03	4.99g	99.8g		14:40				4.97		
Blank		1	24.45	—	100.0g		14:41				4.97		

Analysis Report Thu 09-09-93 11:53:20 AM page 1

Method: GEN Sample Name: BLANK for SF8 -SF9-3 Operator: KFW
Run Time: 09/09/93 11:51:39
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0026	.0352	.0225	.0025	.0003	.0167	.4360
SDev	.0002	.0015	.0006	.0002	.0001	.0057	.0008
%RSD	6.499	4.409	2.834	6.662	25.28	34.15	.1752
#1	.0025	.0336	.0229	.0026	.0003	.0143	.4367
#2	.0028	.0367	.0229	.0026	.0004	.0232	.4360
#3	.0026	.0353	.0218	.0023	.0003	.0125	.4352

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0002	.0255	.0028	.0030	.0028	.0029	.0010
SDev	.0002	.0028	.0006	.0003	.0002	.0003	.0001
%RSD	86.81	11.13	20.87	10.09	6.662	9.989	15.00
#1	.0001	.0230	.0024	.0031	.0030	.0026	.0010
#2	.0004	.0286	.0035	.0033	.0027	.0032	.0011
#3	.0001	.0248	.0026	.0027	.0027	.0029	.0008

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	-.0176	1.328	.0054	.0053	.1161	.0004	.0031
SDev	.0009	.100	.0008	.0002	.0032	.0000	.0011
%RSD	5.310	7.527	14.23	3.535	2.781	.0000	35.04
#1	-.0176	1.322	.0056	.0051	.1133	.0004	.0024
#2	-.0167	1.430	.0061	.0054	.1196	.0004	.0026
#3	-.0186	1.231	.0046	.0054	.1153	.0004	.0043

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	581.5	464.1	.0649	.0073	.0421	.0176	.0697
SDev	1.7	1.2	.0053	.0017	.0058	.0039	.0038
%RSD	.2838	.2671	8.103	22.88	13.76	22.38	5.458
#1	582.7	464.6	.0659	.0061	.0360	.0192	.0735
#2	579.6	462.7	.0696	.0067	.0430	.0131	.0659
#3	582.2	465.1	.0592	.0092	.0475	.0205	.0699

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.0566	.0372	.0058	.0210	-.0020	.0030	.0008
SDev	.0015	.0032	.0001	.0062	.0002	.0003	.0001
%RSD	2.626	8.649	1.575	29.78	9.362	9.401	9.116
#1	.0577	.0383	.0058	.0138	-.0021	.0029	.0008
#2	.0573	.0336	.0059	.0255	-.0018	.0033	.0009
#3	.0549	.0398	.0058	.0235	-.0021	.0028	.0008

Elem	Zn3138	Zr3391
Avge	-.0037	.0018
SDev	.0001	.0003
%RSD	1.644	13.38
#1	-.0036	.0017
#2	-.0037	.0021
#3	-.0037	.0017

9413276.0817

Analysis Report Thu 09-09-93 11:44:05 AM page 1

Method: GEN Sample Name: SF8 Operator: KFW
Run Time: 09/09/93 11:42:24
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0004	.0737	.0136	.0035	.0279	.0158	.5344
SDev	.0007	.0064	.0006	.0002	.0029	.0027	.0009
%RSD	156.3	8.731	4.660	6.277	10.36	17.27	.1781
#1	.0001	.0776	.0139	.0033	.0312	.0142	.5342
#2	-.0000	.0663	.0128	.0034	.0261	.0142	.5335
#3	.0012	.0772	.0140	.0037	.0264	.0189	.5354

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0276	.0120	-.0000	.0292	.0026	.0029	.0010
SDev	.0034	.0035	.0005	.0034	.0007	.0004	.0001
%RSD	12.34	29.41	9995.	11.54	26.02	15.82	15.00
#1	.0313	.0110	-.0003	.0330	.0024	.0033	.0011
#2	.0246	.0090	-.0003	.0268	.0021	.0024	.0008
#3	.0269	.0158	.0006	.0278	.0034	.0030	.0010

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.1052	.7288	.0029	.0340	.1305	.0030	.0013
SDev	.0021	.1682	.0007	.0032	.0022	.0001	.0003
%RSD	1.994	23.07	25.16	9.366	1.675	2.665	24.39
#1	.1076	.7409	.0024	.0377	.1327	.0029	.0011
#2	.1035	.5549	.0026	.0319	.1284	.0031	.0011
#3	.1047	.8906	.0038	.0325	.1303	.0031	.0016

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	588.3	462.4	.0515	.0327	.0705	.0023	.0913
SDev	3.4	1.8	.0051	.0037	.0056	.0026	.0037
%RSD	.5705	.3971	9.878	11.22	7.915	109.5	4.031
#1	590.5	463.8	.0510	.0370	.0655	.0015	.0948
#2	590.0	463.2	.0467	.0309	.0694	.0003	.0875
#3	584.5	460.3	.0568	.0303	.0765	.0052	.0915

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2326	.0378	.0067	.0081	.0007	.0020	.0284
SDev	.0029	.0019	.0001	.0080	.0002	.0003	.0029
%RSD	1.243	5.104	1.375	99.12	26.65	13.85	10.40
#1	.2347	.0396	.0066	.0027	.0008	.0019	.0318
#2	.2293	.0358	.0067	.0043	.0005	.0019	.0265
#3	.2338	.0382	.0067	.0173	.0008	.0024	.0268

Elem	Zn2138	Zr3391
Avge	.0273	.0006
SDev	.0023	.0004
%RSD	10.39	59.96
#1	.0304	.0004
#2	.0252	.0004
#3	.0259	.0010

9HZ276.0818

Analysis Report Thu 09-09-93 11:46:11 AM page 1

Method: GEN Sample Name: SF9-1 Operator: KFW
Run Time: 09/09/93 11:44:31
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0005	.0519	.0114	.0034	.0064	.0105	.5505
SDev	.0004	.0016	.0006	.0002	.0014	.0063	.0005
%RSD	81.02	3.078	5.632	4.879	21.18	60.13	.0908
#1	.0008	.0534	.0107	.0036	.0072	.0119	.5507
#2	.0006	.0502	.0118	.0033	.0072	.0036	.5499
#3	.0000	.0520	.0118	.0033	.0049	.0161	.5509

WHC-SD-EN-TI-240, Rev. 0

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0063	.0110	.0005	.0073	.0023	.0018	.0005
SDev	.0014	.0005	.0006	.0017	.0002	.0003	.0000
%RSD	21.81	4.265	107.9	22.75	8.248	16.81	.0000
#1	.0074	.0116	.0010	.0087	.0024	.0021	.0005
#2	.0068	.0107	.0006	.0078	.0021	.0018	.0005
#3	.0048	.0109	-.0001	.0054	.0024	.0015	.0005

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0333	.7833	.0023	.0111	.1275	.0019	.0012
SDev	.0016	.0862	.0008	.0022	.0049	.0000	.0009
%RSD	4.928	11.01	35.06	19.83	3.809	.0000	78.65
#1	.0345	.8679	.0033	.0128	.1279	.0019	.0009
#2	.0339	.6956	.0017	.0118	.1322	.0019	.0004
#3	.0314	.7863	.0021	.0086	.1225	.0019	.0022

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	587.1	462.1	.0493	.0130	.0410	.0044	.0720
SDev	1.0	1.2	.0013	.0015	.0091	.0042	.0068
%RSD	.1621	.2676	2.673	11.47	22.18	94.72	9.451
#1	587.4	460.8	.0479	.0145	.0472	.0079	.0678
#2	587.9	462.2	.0504	.0132	.0453	-.0002	.0799
#3	586.1	463.2	.0498	.0115	.0306	.0055	.0684

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.1878	.0351	.0063	.0153	-.0010	.0018	.0068
SDev	.0014	.0031	.0000	.0127	.0003	.0004	.0014
%RSD	.7526	8.756	.0000	83.36	33.33	20.93	20.53
#1	.1889	.0363	.0063	.0125	-.0006	.0019	.0078
#2	.1883	.0316	.0063	.0042	-.0010	.0021	.0075
#3	.1862	.0373	.0063	.0292	-.0013	.0014	.0052

Elem	Zn2138	Zr3391
Avge	.0176	.0005
SDev	.0016	.0001
%RSD	8.980	25.52
#1	.0188	.0004
#2	.0182	.0006
#3	.0158	.0004

Analysis Report Thu 09-09-93 11:49:09 AM page 1

Method: GEN Sample Name: SF9-2 Operator: KFW
Run Time: 09/09/93 11:47:28
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0006	.0580	.0116	.0032	.0013	.0103	.5789
SDev	.0007	.0053	.0014	.0002	.0003	.0036	.0006
%RSD	109.2	9.050	12.02	5.094	22.28	34.45	.1050
#1	.0015	.0640	.0118	.0034	.0015	.0107	.5783
#2	.0002	.0550	.0129	.0031	.0010	.0066	.5791
#3	.0002	.0549	.0101	.0031	.0014	.0137	.5794

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0002	.0108	.0004	.0023	.0027	.0016	.0006
SDev	.0003	.0059	.0002	.0008	.0006	.0007	.0002
%RSD	175.4	54.24	60.54	35.53	24.00	43.23	26.65
#1	.0004	.0172	.0001	.0033	.0034	.0024	.0008
#2	-.0002	.0056	.0006	.0017	.0021	.0012	.0005
#3	.0004	.0097	.0004	.0021	.0027	.0012	.0005

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0668	.8105	.0029	.0058	.1321	.0025	.0014
SDev	.0011	.0954	.0014	.0002	.0056	.0002	.0007
%RSD	1.670	11.77	48.48	3.208	4.253	6.298	50.87
#1	.0669	.9088	.0044	.0060	.1385	.0026	.0013
#2	.0656	.8044	.0017	.0057	.1284	.0026	.0022
#3	.0678	.7182	.0025	.0057	.1293	.0024	.0008

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	588.7	465.7	.0504	.0065	.0459	.0057	.0695
SDev	2.7	1.8	.0057	.0002	.0115	.0024	.0022
%RSD	.4506	.3928	11.25	3.471	25.14	42.39	3.128
#1	585.8	463.8	.0569	.0063	.0396	.0071	.0671
#2	590.9	467.5	.0461	.0067	.0592	.0029	.0713
#3	589.4	465.9	.0484	.0066	.0389	.0070	.0702

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2151	.0375	.0066	.0076	-.0006	.0015	.0016
SDev	.0025	.0014	.0000	.0027	.0002	.0005	.0004
%RSD	1.153	3.781	.0000	35.88	41.66	32.94	27.73
#1	.2179	.0361	.0066	.0092	-.0003	.0021	.0020
#2	.2143	.0389	.0066	.0045	-.0008	.0011	.0011
#3	.2131	.0375	.0066	.0093	-.0006	.0014	.0017

Elem	Zn2138	Zr3391
Avge	.0074	.0005
SDev	.0004	.0005
%RSD	5.420	109.9
#1	.0078	.0011
#2	.0070	.0004
#3	.0072	-.0000

9413276.0820

Analysis Report Thu 09-09-93 11:51:13 AM page 1

Method: GEN Sample Name: SF9-3 Operator: KFW
Run Time: 09/09/93 11:49:33
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0026	.0771	.0134	.0037	.0005	.0193	.5646
SDev	.0010	.0047	.0025	.0003	.0001	.0091	.0004
%RSD	38.71	6.055	18.91	7.692	16.59	47.28	.0701
#1	.0015	.0718	.0129	.0034	.0005	.0089	.5650
#2	.0033	.0791	.0162	.0040	.0004	.0260	.5642
#3	.0032	.0805	.0112	.0037	.0005	.0231	.5646

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0004	.0252	.0027	.0030	.0040	.0032	.0011
SDev	.0008	.0042	.0008	.0011	.0009	.0009	.0004
%RSD	198.9	16.59	29.29	35.72	21.45	27.44	34.51
#1	.0001	.0204	.0019	.0018	.0030	.0024	.0007
#2	-.0002	.0273	.0026	.0034	.0047	.0041	.0014
#3	.0013	.0280	.0035	.0038	.0043	.0032	.0012

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0622	1.399	.0054	.0057	.1474	.0026	.0027
SDev	.0004	.150	.0013	.0003	.0042	.0002	.0015
%RSD	.7221	10.70	23.97	5.660	2.831	8.183	56.86
#1	.0618	1.249	.0039	.0054	.1429	.0024	.0009
#2	.0627	1.548	.0063	.0057	.1511	.0026	.0034
#3	.0620	1.399	.0060	.0060	.1482	.0028	.0038

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	582.3	464.1	.0664	.0065	.0428	.0174	.0712
SDev	4.5	2.4	.0067	.0038	.0034	.0041	.0048
%RSD	.7700	.5106	10.11	57.85	7.977	23.62	6.776
#1	587.4	466.6	.0604	.0035	.0396	.0148	.0730
#2	579.9	461.8	.0737	.0108	.0464	.0221	.0749
#3	579.4	464.1	.0653	.0053	.0425	.0153	.0658

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2138	.0395	.0065	.0157	.0003	.0037	.0011
SDev	.0041	.0018	.0001	.0112	.0003	.0008	.0001
%RSD	1.910	4.612	1.408	71.53	91.65	20.33	11.11
#1	.2094	.0376	.0064	.0079	.0000	.0029	.0010
#2	.2175	.0395	.0066	.0106	.0003	.0043	.0013
#3	.2145	.0413	.0066	.0285	.0005	.0038	.0011

Elem	Zn2138	Zr3391
Avge	.0006	.0018
SDev	.0002	.0007
%RSD	33.30	37.25
#1	.0004	.0011
#2	.0005	.0023
#3	.0008	.0021

9W3276.0021

Analysis Report Thu 09-09-93 10:44:10 AM page 1

Method: GEN Sample Name: blank for SF1 to SF7 Operator: KFW
Run Time: 09/09/93 10:42:30
Comment: 3 x dil
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0064	.0391	.0221	.0031	.0004	.0184	.4315
SDev	.0004	.0011	.0022	.0001	.0001	.0015	.0025
%RSD	6.961	2.725	10.12	4.478	20.27	8.206	.5694
#1	.0061	.0380	.0201	.0031	.0005	.0186	.4287
#2	.0061	.0402	.0217	.0030	.0003	.0198	.4327
#3	.0069	.0390	.0245	.0032	.0004	.0168	.4331

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0014	.0421	.0048	.0058	.0012	.0052	.0014
SDev	.0006	.0039	.0004	.0002	.0005	.0005	.0002
%RSD	44.63	9.140	8.246	3.946	41.66	9.287	11.17
#1	.0009	.0414	.0043	.0057	.0006	.0049	.0013
#2	.0012	.0387	.0050	.0056	.0013	.0049	.0013
#3	.0021	.0462	.0050	.0060	.0016	.0058	.0016

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	-.1017	1.889	.0086	.0068	.1336	.0006	.0048
SDev	.0005	.098	.0010	.0003	.0022	.0002	.0003
%RSD	.4879	5.209	11.64	4.478	1.655	35.25	5.811
#1	-.1020	1.808	.0076	.0068	.1337	.0004	.0050
#2	-.1020	1.861	.0086	.0065	.1313	.0008	.0048
#3	-.1012	1.998	.0096	.0071	.1357	.0007	.0045

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	545.9	455.4	.0805	.0110	.0576	.0282	.0793
SDev	2.1	1.1	.0047	.0021	.0028	.0029	.0066
%RSD	.3822	.2499	5.792	19.15	4.807	10.19	8.390
#1	544.2	454.9	.0780	.0106	.0558	.0249	.0752
#2	548.3	456.7	.0777	.0091	.0607	.0299	.0757
#3	545.4	454.7	.0859	.0133	.0561	.0298	.0870

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.0642	.0461	.0043	.0197	-.0012	.0048	.0015
SDev	.0021	.0043	.0015	.0080	.0002	.0004	.0001
%RSD	3.308	9.345	35.48	40.57	13.64	8.827	4.811
#1	.0627	.0433	.0034	.0128	-.0013	.0043	.0016
#2	.0633	.0452	.0034	.0173	-.0012	.0051	.0015
#3	.0667	.0507	.0061	.0285	-.0010	.0051	.0015

Elem	Zn2138	Zr3391
Avge	.0013	.0037
SDev	.0003	.0003
%RSD	25.87	8.811
#1	.0011	.0034
#2	.0011	.0036
#3	.0017	.0040

WHC-3276.0822

Analysis Report Thu 09-09-93 10:48:32 AM page 1

Method: GEN Sample Name: SF1 Operator: KFW
Run Time: 09/09/93 10:46:51
Comment: 3 x dil
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0081	.0916	.0152	.0047	.0003	.0325	.5849
SDev	.0003	.0037	.0014	.0001	.0000	.0042	.0016
%RSD	3.812	4.047	9.169	1.698	.6822	12.85	.2784
#1	.0078	.0875	.0166	.0046	.0003	.0286	.5835
#2	.0081	.0948	.0150	.0048	.0003	.0369	.5867
#3	.0084	.0924	.0139	.0048	.0003	.0321	.5847

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0017	.0559	.0073	.0079	.0040	.0068	.0020
SDev	.0005	.0020	.0002	.0001	.0002	.0002	.0001
%RSD	26.97	3.652	3.133	1.103	4.558	2.368	6.818
#1	.0012	.0542	.0075	.0080	.0038	.0066	.0019
#2	.0018	.0581	.0073	.0078	.0041	.0069	.0020
#3	.0021	.0553	.0071	.0080	.0041	.0069	.0022

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	-.0366	2.474	.0119	.0074	.1825	.0027	.0066
SDev	.0007	.110	.0003	.0006	.0052	.0001	.0006
%RSD	1.779	4.442	2.110	8.219	2.825	3.039	9.463
#1	-.0373	2.348	.0116	.0068	.1823	.0027	.0063
#2	-.0363	2.552	.0121	.0074	.1877	.0027	.0063
#3	-.0361	2.521	.0119	.0080	.1774	.0028	.0074

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	548.8	455.3	.0946	.0119	.0706	.0449	.1015
SDev	1.0	.8	.0019	.0024	.0068	.0029	.0039
%RSD	.1804	.1739	2.024	20.46	9.684	6.446	3.856
#1	549.9	456.2	.0925	.0120	.0641	.0419	.1059
#2	548.7	454.9	.0962	.0095	.0778	.0477	.0998
#3	547.9	454.7	.0952	.0144	.0699	.0451	.0986

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2214	.0513	.0069	.0186	.0014	.0071	.0018
SDev	.0025	.0012	.0000	.0068	.0001	.0006	.0000
%RSD	1.117	2.392	.0000	36.74	6.415	7.982	.0000
#1	.2192	.0509	.0069	.0258	.0014	.0068	.0018
#2	.2210	.0527	.0069	.0178	.0015	.0077	.0018
#3	.2241	.0503	.0069	.0122	.0014	.0068	.0018

Elem	Zn2138	Zr3391
Avge	.0088	.0049
SDev	.0001	.0003
%RSD	1.282	4.974
#1	.0087	.0047
#2	.0089	.0051
#3	.0088	.0051

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Method: GEN Sample Name: SF2 Operator: KFW
Run Time: 09/09/93 10:49:04
Comment: 3 x dil
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0104	.1104	.0175	.0054	.0003	.0384	.5268
SDev	.0006	.0016	.0013	.0001	.0000	.0018	.0010
%RSD	5.631	1.486	7.307	1.493	.3485	4.723	.1922
#1	.0101	.1110	.0183	.0053	.0003	.0404	.5278
#2	.0110	.1117	.0161	.0055	.0003	.0380	.5270
#3	.0099	.1085	.0183	.0053	.0003	.0369	.5258

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0026	.0715	.0097	.0106	.0056	.0091	.0026
SDev	.0003	.0008	.0003	.0001	.0002	.0003	.0001
%RSD	13.33	1.174	2.725	.8135	3.268	3.095	3.039
#1	.0024	.0724	.0098	.0105	.0057	.0091	.0026
#2	.0030	.0713	.0098	.0106	.0057	.0094	.0027
#3	.0024	.0708	.0094	.0106	.0054	.0088	.0026

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	-.0354	3.148	.0159	.0090	.1944	.0033	.0077
SDev	.0001	.114	.0008	.0007	.0024	.0001	.0006
%RSD	.2812	3.630	5.272	7.785	1.245	2.510	8.457
#1	-.0353	3.129	.0160	.0086	.1960	.0032	.0070
#2	-.0355	3.271	.0167	.0098	.1955	.0034	.0083
#3	-.0355	3.045	.0150	.0086	.1916	.0032	.0079

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	539.8	448.9	.1172	.0168	.0709	.0591	.0986
SDev	2.3	1.2	.0050	.0005	.0066	.0020	.0047
%RSD	.4342	.2649	4.276	2.768	9.364	3.331	4.809
#1	541.4	449.8	.1157	.0166	.0785	.0589	.0934
#2	537.1	447.5	.1228	.0166	.0676	.0611	.1026
#3	540.8	449.3	.1131	.0174	.0665	.0572	.1000

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2246	.0525	.0070	.0281	.0024	.0091	.0023
SDev	.0015	.0012	.0000	.0061	.0002	.0003	.0001
%RSD	.6775	2.234	.0000	21.61	9.962	3.089	6.298
#1	.2246	.0537	.0070	.0327	.0025	.0090	.0022
#2	.2261	.0524	.0070	.0305	.0026	.0095	.0025
#3	.2231	.0514	.0070	.0312	.0021	.0090	.0022

Elem	Zn2138	Zr3391
Avge	.0119	.0064
SDev	.0009	.0001
%RSD	7.461	1.893
#1	.0110	.0064
#2	.0119	.0066
#3	.0128	.0064

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Analysis Report Thu 09-09-93 11:02:29 AM page 1

Method: GEN Sample Name: SF4 Operator: KFW
Run Time: 09/09/93 11:00:48
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0148	.1483	.0212	.0064	.0058	.0498	.5560
SDev	.0017	.0070	.0011	.0004	.0013	.0022	.0009
%RSD	11.47	4.724	5.370	6.641	22.38	4.314	.1668
#1	.0142	.1466	.0215	.0063	.0073	.0522	.5550
#2	.0134	.1424	.0199	.0060	.0051	.0481	.5564
#3	.0167	.1561	.0221	.0068	.0050	.0492	.5567

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0089	.0983	.0127	.0199	.0097	.0125	.0037
SDev	.0011	.0096	.0014	.0017	.0010	.0010	.0004
%RSD	12.75	9.741	11.41	8.679	10.60	7.731	9.922
#1	.0102	.0941	.0119	.0211	.0092	.0119	.0035
#2	.0084	.0915	.0119	.0179	.0089	.0119	.0034
#3	.0081	.1092	.0144	.0208	.0108	.0136	.0041

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	-.0248	4.149	.0224	.0163	.2217	.0037	.0116
SDev	.0007	.437	.0023	.0014	.0093	.0001	.0004
%RSD	2.623	10.54	10.44	8.402	4.187	2.221	3.610
#1	-.0241	3.980	.0217	.0177	.2176	.0036	.0112
#2	-.0253	3.820	.0205	.0150	.2151	.0036	.0119
#3	-.0251	4.645	.0250	.0162	.2323	.0038	.0119

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	540.2	451.9	.1461	.0282	.0843	.0845	.1154
SDev	5.8	4.5	.0129	.0016	.0062	.0091	.0022
%RSD	1.080	.9922	8.820	5.762	7.358	10.81	1.930
#1	541.8	453.7	.1390	.0297	.0895	.0798	.1156
#2	545.1	455.3	.1384	.0265	.0860	.0787	.1130
#3	533.8	446.8	.1610	.0283	.0775	.0951	.1174

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2546	.0588	.0072	.0299	.0040	.0127	.0085
SDev	.0038	.0024	.0001	.0155	.0004	.0012	.0012
%RSD	1.482	4.086	1.246	51.74	11.40	9.498	14.25
#1	.2547	.0590	.0072	.0127	.0037	.0122	.0099
#2	.2507	.0563	.0072	.0343	.0037	.0119	.0076
#3	.2583	.0611	.0073	.0427	.0045	.0141	.0080

Elem	Zn2138	Zr3391
Avge	.0223	.0090
SDev	.0010	.0009
%RSD	4.501	9.566
#1	.0235	.0085
#2	.0215	.0085
#3	.0219	.0099

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Analysis Report Thu 09-09-93 11:06:35 AM page 1

Method: GEN Sample Name: SF5 Operator: KFW
Run Time: 09/09/93 11:04:55
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0094	.1087	.0185	.0051	.0008	.0361	.5907
SDev	.0009	.0036	.0012	.0001	.0001	.0066	.0008
%RSD	9.538	3.272	6.296	1.575	9.896	18.22	.1334
#1	.0084	.1050	.0189	.0050	.0009	.0405	.5899
#2	.0101	.1120	.0172	.0052	.0009	.0392	.5915
#3	.0098	.1090	.0194	.0050	.0007	.0285	.5907

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0027	.0635	.0085	.0099	.0053	.0077	.0023
SDev	.0003	.0070	.0009	.0011	.0007	.0007	.0003
%RSD	11.11	11.05	10.82	10.88	12.49	9.544	12.00
#1	.0030	.0573	.0075	.0087	.0048	.0072	.0020
#2	.0027	.0711	.0094	.0108	.0061	.0086	.0026
#3	.0024	.0620	.0087	.0102	.0051	.0074	.0023

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	-.0312	2.818	.0138	.0088	.1963	.0028	.0075
SDev	.0006	.204	.0014	.0005	.0070	.0001	.0010
%RSD	1.988	7.221	9.860	5.267	3.569	2.887	13.35
#1	-.0317	2.592	.0123	.0083	.1887	.0028	.0065
#2	-.0305	2.987	.0149	.0092	.2024	.0029	.0075
#3	-.0313	2.876	.0141	.0089	.1980	.0028	.0084

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	549.2	460.0	.1042	.0174	.0777	.0532	.0987
SDev	5.1	2.4	.0096	.0013	.0088	.0041	.0036
%RSD	.9225	.5109	9.174	7.283	11.37	7.736	3.615
#1	554.7	462.7	.0951	.0160	.0677	.0491	.1027
#2	544.8	458.3	.1142	.0178	.0842	.0532	.0959
#3	548.0	459.0	.1034	.0184	.0813	.0573	.0974

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2124	.0508	.0071	.0296	.0017	.0085	.0024
SDev	.0020	.0042	.0001	.0045	.0004	.0006	.0002
%RSD	.9261	8.338	1.274	15.36	22.88	7.638	7.901
#1	.2106	.0465	.0070	.0270	.0014	.0080	.0022
#2	.2145	.0508	.0070	.0269	.0021	.0092	.0026
#3	.2121	.0550	.0072	.0348	.0017	.0082	.0025

Elem	Zn2138	Zr3391
Avge	.0119	.0057
SDev	.0004	.0004
%RSD	3.742	7.783
#1	.0115	.0053
#2	.0124	.0061
#3	.0118	.0055

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Analysis Report Thu 09-09-93 11:08:45 AM page 1

Method: GEN Sample Name: SF6 Operator: KFW
Run Time: 09/09/93 11:07:05
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0111	.1349	.0186	.0059	.0008	.0433	.5947
SDev	.0007	.0065	.0006	.0002	.0001	.0100	.0008
%RSD	6.396	4.802	3.469	3.580	10.51	23.10	.1346
#1	.0107	.1288	.0182	.0057	.0007	.0398	.5939
#2	.0107	.1340	.0194	.0059	.0007	.0356	.5947
#3	.0119	.1417	.0182	.0061	.0009	.0547	.5955

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0033	.0727	.0100	.0117	.0067	.0094	.0027
SDev	.0009	.0024	.0008	.0003	.0006	.0003	.0002
%RSD	27.28	3.277	8.052	2.209	9.524	2.997	5.973
#1	.0024	.0700	.0101	.0115	.0067	.0094	.0026
#2	.0033	.0735	.0091	.0115	.0061	.0091	.0026
#3	.0042	.0746	.0107	.0120	.0073	.0097	.0029

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0064	3.244	.0164	.0091	.2171	.0042	.0089
SDev	.0005	.178	.0008	.0007	.0047	.0002	.0007
%RSD	7.167	5.487	4.576	7.698	2.155	3.936	8.261
#1	.0069	3.120	.0156	.0083	.2142	.0041	.0081
#2	.0060	3.164	.0164	.0095	.2146	.0041	.0095
#3	.0062	3.448	.0171	.0095	.2225	.0044	.0090

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	548.6	459.8	.1178	.0177	.0821	.0631	.1102
SDev	3.2	1.4	.0049	.0009	.0062	.0067	.0049
%RSD	.5889	.3084	4.166	4.844	7.519	10.60	4.437
#1	550.6	461.3	.1141	.0170	.0815	.0615	.1151
#2	550.3	459.6	.1159	.0174	.0885	.0574	.1053
#3	544.9	458.4	.1234	.0187	.0762	.0705	.1103

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2936	.0543	.0075	.0355	.0037	.0100	.0026
SDev	.0019	.0007	.0000	.0033	.0002	.0004	.0001
%RSD	.6326	1.299	.0000	9.409	4.949	3.733	4.839
#1	.2940	.0548	.0075	.0317	.0036	.0100	.0026
#2	.2915	.0546	.0075	.0367	.0036	.0097	.0025
#3	.2952	.0535	.0075	.0381	.0039	.0104	.0027

Elem	Zn2138	Zr3391
Avge	.0114	.0070
SDev	.0001	.0004
%RSD	.8327	5.275
#1	.0113	.0068
#2	.0114	.0068
#3	.0115	.0074

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Analysis Report Thu 09-09-93 11:10:56 AM page 1

Method: GEN Sample Name: SF7 Operator: KFW
Run Time: 09/09/93 11:09:16
Comment: 3 X DIL
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0119	.1329	.0184	.0057	.0006	.0400	.5479
SDev	.0005	.0009	.0008	.0001	.0001	.0111	.0019
%RSD	4.169	.7175	4.542	2.419	13.09	27.64	.3398
#1	.0113	.1326	.0177	.0056	.0006	.0285	.5483
#2	.0123	.1321	.0193	.0059	.0006	.0409	.5459
#3	.0121	.1339	.0182	.0057	.0007	.0505	.5495

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0027	.0776	.0104	.0122	.0075	.0096	.0028
SDev	.0003	.0037	.0003	.0002	.0007	.0006	.0001
%RSD	11.11	4.814	3.365	1.857	8.796	6.085	2.839
#1	.0024	.0738	.0101	.0120	.0070	.0091	.0027
#2	.0027	.0813	.0107	.0124	.0073	.0102	.0029
#3	.0030	.0778	.0103	.0123	.0083	.0094	.0029

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	-.0124	3.463	.0175	.0093	.2153	.0036	.0100
SDev	.0005	.091	.0008	.0003	.0050	.0001	.0008
%RSD	4.163	2.631	4.336	3.765	2.337	2.279	7.579
#1	-.0124	3.368	.0168	.0089	.2097	.0035	.0097
#2	-.0129	3.550	.0183	.0095	.2195	.0036	.0108
#3	-.0119	3.470	.0175	.0095	.2166	.0036	.0094

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	543.7	457.4	.1250	.0192	.0855	.0733	.1008
SDev	3.1	1.8	.0022	.0006	.0013	.0032	.0041
%RSD	.5636	.3924	1.785	3.070	1.468	4.304	4.064
#1	547.0	458.2	.1225	.0185	.0866	.0704	.1017
#2	541.0	455.3	.1268	.0194	.0858	.0729	.0964
#3	543.0	458.6	.1256	.0197	.0842	.0766	.1044

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2536	.0573	.0073	.0225	.0035	.0104	.0026
SDev	.0015	.0013	.0001	.0032	.0002	.0004	.0002
%RSD	.5977	2.213	1.237	14.08	5.170	3.607	7.274
#1	.2521	.0575	.0072	.0261	.0034	.0099	.0025
#2	.2535	.0585	.0073	.0210	.0037	.0107	.0029
#3	.2551	.0560	.0073	.0203	.0034	.0104	.0026

Elem	Zn2138	Zr3391
Avge	.0082	.0073
SDev	.0002	.0002
%RSD	2.034	3.356
#1	.0081	.0070
#2	.0081	.0074
#3	.0084	.0074

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ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

1.0 ICP Analysis
The solutions from the fused samples were analyzed on the ICP at 324 Building

2.0	Lab No	0			0		
3.0	Customer	Rick Merrill			Rick Merrill		
4.0	Customer's ID	SF-2 100SFR-2			SF-2 100-SFR-2		
5.0	Fusion Method	KOH	Na2O2		KOH	Na2O2	
6.0	Sample Wt	0.276 g	0.288 g		0.276 g	0.288 g	
7.0	Dilution	2500 mL	2500 mL		2500 mL	2500 mL	

8.0 Analysis

Element	Wt % Element	Wt % Element
Ag	0.009%	-0.004%
Al	8.069%	8.158%
B	-0.009%	-0.009%
Ba	0.082%	0.080%
Be	-0.003%	-0.003%
Bi	-0.054%	-0.052%
Ca	6.268%	5.735%
Cd	-0.005%	-0.005%
Ce	0.061%	-0.035%
Co	0.016%	-0.009%
Cr	0.022%	0.029%
Cu	0.013%	0.007%
Dy	-0.005%	-0.005%
Eu	-0.004%	-0.003%
Fe	4.241%	3.885%
K		2.063%
La	0.016%	0.014%
Li	0.007%	0.004%
Mg	1.187%	1.091%
Mn	0.081%	0.068%
Mo	0.017%	0.014%
Na	4.193%	
Nd	0.054%	0.056%
Ni		0.042%
P	0.123%	0.146%
Pb	0.134%	0.100%
S	-0.072%	-0.069%
Si	29.090%	27.111%
Sn	-0.072%	-0.069%
Sr	0.037%	0.039%
Te	-0.054%	-0.052%
Ti	0.566%	0.528%
V	0.022%	0.020%
Y	0.004%	0.004%
Zn	0.033%	0.036%
Zr	0.034%	

Oxide	Wt % Oxide	Wt % Oxide	Average Wt % Oxide		Percent Deviation Oxide
Ag2O	0.009%	-0.005%	0.00%		612%
Al2O3	15.247%	15.414%	15.33%		-1%
B2O3	-0.029%	-0.028%	-0.03%		4%
BaO	0.092%	0.090%	0.09%		2%
BeO	-0.008%	-0.007%	-0.01%		4%
Bi2O3	-0.061%	-0.058%	-0.06%		4%
CaO	8.770%	8.025%	8.77%		
CdO	-0.006%	-0.006%	-0.01%		4%
CeO2	0.075%	-0.043%	0.02%		735%
Co2O3	0.022%	-0.012%	0.00%		706%
Cr2O3	0.032%	0.042%	0.04%		-27%
CuO	0.016%	0.009%	0.01%		60%
Dy2O3	-0.006%	-0.006%	-0.01%		4%
Eu2O3	-0.004%	-0.004%	0.00%		4%
Fe2O3	6.063%	5.553%	5.81%		9%
K2O		2.485%	2.49%		
La2O3	0.019%	0.016%	0.02%		17%
Li2O	0.014%	0.010%	0.01%		40%
MgO	1.969%	1.810%	1.89%		8%
MnO	0.128%	0.107%	0.12%		18%
MoO3	0.025%	0.021%	0.02%		17%
Na2O	5.651%		5.65%		
Nd2O3	0.063%	0.065%	0.06%		-4%
NiO		0.053%	0.05%		
P2O5	0.282%	0.334%	0.31%		-17%
PbO	0.145%	0.107%	0.13%		30%
SO3	-0.181%	-0.173%	-0.18%		4%
SiO2	62.228%	57.994%	60.11%		7%
SnO2	-0.092%	-0.088%	-0.09%		4%
SrO	0.043%	0.047%	0.04%		-8%
TeO2	-0.068%	-0.065%	-0.07%		4%
TiO2	0.945%	0.880%	0.91%		7%
V2O5	0.035%	0.032%	0.03%		10%
Y2O3	0.005%	0.005%	0.01%		9%
ZnO	0.041%	0.045%	0.04%		-10%
ZrO2	0.047%		0.05%		

9.0 Sub-total = 54.39% 46.23% Sub-total = 101.963% 83.988%

K= 2.063% Na= 4.193% K2O= 2.485% Na2O= 5.651%

Ni= 0.042% Zr= 0.034% NiO= 0.053% ZrO2= 0.047%

10.0 Total = 56.48% 53.45% Total = 104.5% 89.6% 102.0%

11.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na2O2 fusion is performed in zirconium metal crucible. Thus the Zr and Na reported are values obtained from the KOH/Ni fusion.

12.0 Comment: At low concentration of Ca, the Na2O2 fusion is not included in the average value.
Negative values reported in this procedure are at or below the estimated detection limit for the ICP/AES procedure.

12.0 Calculated by and date

13.0 Approved by and date

9413276.0829

ICP ANALYSIS ON FUSED SAMPLES
Analytical and Process Support Laboratory

1.0	Lab No		
2.0	Customer	Rick Merrill	
3.0	Customer's Sample ID	SF-2 100 SFR2	
4.0	Fusion Method	KOH	Na2O2
5.0	Sample Wt	0.2760	0.2880
6.0	Dilution	2500	2500

7.0 ICP Analysis
The fusions were performed by the Analytical and Support Laboratory.
The solutions from the fused samples were analyzed on the ICP at 324 Building.

Element	Detection Limit	Element Conc (ug/mL)	KOH Wt % Element	Element Conc (ug/mL)	Na2O2 Wt% Element	Oxide	Conversion Factor	KOH Wt% Oxide	Na2O2 Wt% Oxide
Ag	0.005	0.00944	0.009%	-0.04003	-0.004%	AgO	1.0743	0.009%	-0.005%
Al	0.03	8.90906	8.069%	8.39769	8.158%	Al2O3	1.8895	15.247%	15.414%
B	0.01	0.00825	-0.009%	-0.00163	-0.009%	B2O3	3.2202	-0.029%	-0.028%
Ba	0.003	0.09066	0.082%	0.09248	0.090%	BaO	1.1165	0.092%	0.090%
Be	0.003	0.00055	-0.003%	0.00125	-0.003%	BeO	2.7752	-0.008%	-0.007%
Bi	0.06	0.04921	-0.054%	0.04764	-0.052%	Bi2O3	1.1148	-0.061%	-0.058%
Ca	0.01	6.91939	6.268%	6.6069	5.735%	CaO	1.3992	8.770%	8.025%
Cd	0.006	0.00476	-0.005%	0.00281	-0.005%	CdO	1.1423	-0.006%	-0.006%
Ce	0.04	0.06702	0.061%	-0.24094	-0.035%	CeO2	1.2284	0.075%	-0.043%
Co	0.01	0.01716	0.016%	0.00964	-0.009%	Co2O3	1.4073	0.022%	-0.012%
Cr	0.02	0.02418	0.022%	0.03295	0.029%	Cr2O3	1.4618	0.032%	0.042%
Cu	0.006	0.01409	0.013%	0.00795	0.007%	CuO	1.2517	0.016%	0.009%
Dy	0.006	0.00585	-0.005%	0.00501	-0.005%	Dy2O3	1.1477	-0.006%	-0.006%
Eu	0.004	0.00197	-0.004%	0.00212	-0.003%	Eu2O3	1.1579	-0.004%	-0.004%
Fe	0.005	4.68184	4.241%	4.47495	3.885%	Fe2O3	1.4296	6.063%	5.553%
K	0.3	430.1465		2.37893	2.063%	K2O	1.2046		2.485%
La	0.01	0.01807	0.016%	0.01598	0.014%	La2O3	1.1728	0.019%	0.016%
Li	0.005	0.00735	0.007%	0.00512	0.004%	Li2O	2.1527	0.014%	0.010%
Mg	0.06	1.31082	1.187%	1.25683	1.091%	MgO	1.6586	1.969%	1.810%
Mn	0.003	0.08949	0.081%	0.07814	0.068%	MnO	1.5825	0.128%	0.107%
Mo	0.01	0.01828	0.017%	0.01611	0.014%	MoO3	1.5004	0.025%	0.021%
Na	0.05	4.62852	4.193%	403.1309		Na2O	1.348	5.651%	
		5.10728		409.8084					
Nd	0.02	0.0596	0.054%	0.06443	0.056%	Nd2O3	1.1664	0.063%	0.065%
Ni	0.02	1.84675		0.04797	0.042%	NiO	1.2725		0.053%
P	0.06	0.13576	0.123%	0.16807	0.146%	P2O5	2.2913	0.282%	0.334%
Pb	0.06	0.14817	0.134%	0.1148	0.100%	PbO	1.0777	0.145%	0.107%
S	0.06	0.04339	-0.072%	-0.01537	-0.069%	SO3	2.4967	-0.181%	-0.173%
Si	0.01	32.11549	29.090%	31.23149	27.111%	SiO2	2.1391	62.228%	57.994%
Sn	0.06	0.05383	-0.072%	0.05166	-0.069%	SnO2	1.2696	-0.092%	-0.088%
Sr	0.003	0.04033	0.037%	0.04537	0.039%	SrO	1.1827	0.043%	0.047%
Te	0.06	0.0547	-0.054%	0.03918	-0.052%	TeO2	1.2508	-0.068%	-0.065%
Ti	0.003	0.62529	0.566%	0.60769	0.528%	TiO2	1.6681	0.945%	0.880%
V	0.01	0.02385	0.022%	0.02254	0.020%	VO2	1.6282	0.035%	0.032%
Y	0.003	0.00459	0.004%	0.00436	0.004%	Y2O3	1.2699	0.005%	0.005%
Zn	0.01	0.03607	0.033%	0.04163	0.036%	ZnO	1.2448	0.041%	0.045%
Zr	0.01	0.03605	0.034%	15.30316		ZrO2	1.3508	0.047%	
		1000		1000					
8.0		Sub-total =	54.38%		49.23%		Sub-total =	101.965%	93.144%
		Plus K=	2.063%	Plus Na=	4.193%		Plus K2O	2.485%	Plus Na2O 5.651%
		Plus Ni=	0.042%	Plus Zr=	0.034%		Plus NiO	0.053%	Plus ZrO2 0.047%
9.0		Total =	56.48%		53.45%		Total =	104.503%	98.842%

10.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2 /Zr fusion. The Na and Zr reported on the Na2O2/Zr crucible are values obtained from the KOH/Ni fusion.

DH 9276.0830

ICP ANALYSIS ON FUSED SAMPLES
Analytical and Process Support Laboratory

1.0	Lab No		300 AREA SFR-2
2.0	Data File No		Fused Soil
3.0	Customer		R Merrill
4.0	Customer's Sample ID		Data 11
5.0	Fusion Method	KOH	Na2O2
6.0	Sample Wt	0.3170	0.3280
7.0	Dilution	2500	2500

8.0 ICP Analysis

The fusions were performed by the Analytical and Support Laboratory.

The solutions from the fused samples were analyzed on the ICP at 324 Building.

Element	Detection Limit	Element Conc (ug/mL)	KOH Wt % Element	Element Conc (ug/mL)	Na2O2 Wt % Element	Oxide	Conversion Factor	KOH Wt % Oxide		Na2O2 Wt % Oxide
Ag	0.005	0.00085	-0.004%	-0.0303	-0.004%	AgO	1.07428	-0.004%		-0.004%
Al	0.03	8.26459	6.518%	8.01114	6.186%	Al2O3	1.88955	12.316%		11.538%
B	0.01	0.01373	0.011%	-0.00478	-0.008%	B2O3	3.22017	0.035%		-0.025%
Ba	0.003	0.14849	0.117%	0.1503	0.115%	BaO	1.1165	0.131%		0.128%
Be	0.003	0.0002	-0.002%	0.00063	-0.002%	BeO	2.77519	-0.007%		-0.006%
Bi	0.06	0.01846	-0.047%	0.02754	-0.046%	Bi2O3	1.11484	-0.053%		-0.051%
Ca	0.01	7.58616	5.991%	7.58679	5.783%	CaO	1.3992	8.382%		8.091%
Cd	0.006	0.00113	-0.005%	0.00129	-0.005%	CdO	1.14235	-0.005%		-0.005%
Ce	0.04	0.0189	-0.032%	-0.17985	-0.038%	CeO2	1.22845	-0.039%		-0.037%
Co	0.01	0.0073	-0.008%	0.00839	-0.008%	Co2O3	1.40726	-0.011%		-0.011%
Cr	0.02	0.01597	-0.016%	0.02621	0.020%	Cr2O3	1.46184	-0.023%		0.029%
Cu	0.006	0.05448	0.043%	0.0536	0.041%	CuO	1.25169	0.054%		0.051%
Dy	0.006	0.00121	-0.005%	0.00218	-0.005%	Dy2O3	1.14769	-0.005%		-0.005%
Eu	0.004	0.00057	-0.003%	0.00129	-0.003%	Eu2O3	1.15794	-0.004%		-0.004%
Fe	0.005	6.27328	4.947%	6.07537	4.631%	Fe2O3	1.42963	7.073%		6.620%
K	0.3	367.7705		1.56613	1.278%	K2O	1.2046			1.538%
La	0.01	0.00685	-0.005%	0.0112	0.005%	La2O3	1.17277	-0.009%		0.010%
Li	0.005	0.00295	-0.004%	0.00321	-0.004%	Li2O	2.15274	-0.005%		-0.005%
Mg	0.06	1.57828	1.243%	1.51584	1.155%	MgO	1.65858	2.062%		1.916%
Mn	0.003	0.10181	0.080%	0.09838	0.075%	MnO	1.58245	0.127%		0.116%
Mo	0.01	0.01083	0.009%	0.01163	0.009%	MoO3	1.50042	0.013%		0.013%
Na	0.05	4.40785	3.476%	398.46398		Na2O	1.34798	4.686%		
Nd	0.02	0.019	-0.016%	0.04728	0.036%	Nd2O3	1.16639	-0.018%		0.041%
Ni	0.02	2.15933		0.03914	0.030%	NiO	1.27253			0.038%
P	0.08	0.18349	0.145%	0.18501	0.141%	P2O5	2.29128	0.332%		0.323%
Pb	0.08	0.06784	-0.053%	0.08127	0.062%	PbO	1.0777	-0.058%		0.067%
S	0.08	0.05532	-0.043%	0.02171	-0.041%	SO3	2.49673	-0.158%		-0.152%
Si	0.01	34.65079	27.327%	33.66936	25.677%	SiO2	2.13914	58.457%		54.927%
Sn	0.08	0.04826	-0.063%	0.05391	-0.041%	SnO2	1.26961	-0.080%		-0.077%
Sr	0.003	0.04746	0.037%	0.0533	0.041%	SrO	1.18272	0.044%		0.048%
Te	0.06	0.02769	-0.047%	0.04422	-0.046%	TeO2	1.25078	-0.059%		-0.057%
Ti	0.003	0.90445	0.713%	0.88199	0.672%	TiO2	1.66806	1.190%		1.121%
V	0.01	0.02507	0.020%	0.02613	0.020%	VO2	1.62819	0.032%		0.032%
Y	0.003	0.003	0.002%	0.00345	0.003%	Y2O3	1.26988	0.003%		0.003%
Zn	0.01	0.0606	0.048%	0.03583	0.027%	ZnO	1.24476	0.059%		0.034%
Zr	0.01	0.05149	0.041%	10.78126		ZrO2	1.3508	0.055%		
9.0		Sub-total=	50.77%	Sub-total=	45.92%		Sub-total=	95.056%	Sub-total=	86.679%
		Plus B=	1.278%	Plus Na=	3.476%		Plus B2O3=	1.538%	Plus Na2O	4.686%
		Plus Mn=	0.010%	Plus Zr=	0.041%		Plus MnO=	0.013%	Plus ZrO2	0.055%
10.0		Total =	52.07%	Total =	49.44%		Total =	96.62%	Total =	91.42%

11.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2/Zr fusion.
The Na and Zr reported on the Na2O2/Zr crucible are values obtained from the KOH fusion using the nickel crucible.

DH 3276-183

ICP ANALYSIS ON FUSED SAMPLES

Analytical and Process Support Laboratory

ICP Analysis
The solutions from the fused samples were analyzed on the ICP at 324 Building

1.0	Lab No	300 AREA SFR-2	300 Area Grab Class	300 AREA SFR-2		
2.0	Data File No	Fused Soil		R Merrill		
3.0	Customer	R Merrill		Data 11		
4.0	Customer's ID	Data 11				
5.0	Fusion Method	KOH	Na2O2	KOH	Na2O2	
6.0	Sample Wt	0.3170 g	0.3280 g	0.317 g	0.328 g	
7.0	Dilution	2500 mL	2500 mL	2500 mL	2500 mL	

8.0 Analysis

Element	Wt % Element	Wt % Element
Ag	-0.004%	-0.004%
Al	6.518%	6.196%
B	0.011%	-0.008%
Ba	0.117%	0.115%
Be	-0.002%	-0.002%
Bi	-0.047%	-0.046%
Ca	5.991%	5.783%
Cd	-0.005%	-0.005%
Ce	-0.032%	-0.030%
Co	-0.008%	-0.008%
Cr	-0.016%	0.028%
Cu	0.043%	0.041%
Dy	-0.005%	-0.005%
Eu	-0.003%	-0.003%
Fe	4.947%	4.631%
K		1.278%
La	-0.008%	0.009%
Li	-0.004%	-0.004%
Mg	1.243%	1.155%
Mn	0.088%	0.073%
Mo	0.009%	0.009%
Na	3.476%	
Nd	-0.016%	0.036%
Ni		0.038%
P	0.145%	0.141%
Pb	-0.063%	0.062%
S	-0.063%	-0.061%
Si	27.327%	25.677%
Sn	-0.063%	-0.061%
Sr	0.037%	0.041%
Ta	-0.047%	-0.046%
Ti	0.713%	0.672%
V	0.028%	0.028%
Y	0.002%	0.003%
Zn	0.048%	0.027%
Zr	0.041%	

Oxide	Wt % Oxide	Wt % Oxide	Average Wt % Oxide	Percent Deviation Oxide
Ag2O	-0.004%	-0.004%	0.00%	3%
Al2O3	12.316%	11.538%	11.93%	7%
B2O3	0.035%	-0.025%	0.01%	1151%
BaO	0.131%	0.128%	0.13%	2%
BeO	-0.007%	-0.006%	-0.01%	3%
Bi2O3	-0.053%	-0.051%	-0.05%	3%
CaO	8.382%	8.091%	8.24%	
CdO	-0.005%	-0.005%	-0.01%	3%
CeO2	-0.039%	-0.037%	-0.04%	3%
Co2O3	-0.011%	-0.011%	-0.01%	3%
Cr2O3	-0.023%	0.029%	0.00%	-1701%
CuO	0.054%	0.051%	0.05%	5%
Dy2O3	-0.005%	-0.005%	-0.01%	3%
Eu2O3	-0.004%	-0.004%	0.00%	3%
Fe2O3	7.073%	6.628%	6.85%	7%
K2O		1.538%	1.53%	
La2O3	-0.009%	0.010%	0.00%	-5852%
Li2O	-0.008%	-0.008%	-0.01%	3%
MgO	2.062%	1.916%	1.99%	7%
MnO	0.127%	0.116%	0.12%	9%
MoO3	0.013%	0.013%	0.01%	-3%
Na2O	4.686%		4.69%	
Nd2O3	-0.018%	0.042%	0.01%	-511%
NiO		0.038%	0.04%	
P2O5	0.332%	0.323%	0.33%	3%
PbO	-0.068%	0.067%	0.00%	21785%
SO3	-0.152%	-0.152%	-0.15%	3%
SiO2	58.457%	54.927%	56.69%	6%
SnO2	-0.088%	-0.077%	-0.08%	3%
SrO	0.044%	0.045%	0.05%	-8%
TeO2	-0.059%	-0.057%	-0.06%	3%
TiO2	1.190%	1.121%	1.16%	6%
VO2	0.032%	0.032%	0.03%	-1%
Y2O3	0.003%	0.003%	0.00%	-11%
ZnO	0.059%	0.034%	0.05%	54%
ZrO2	0.055%		0.05%	

9.0

Sub-total=	58.77%	Sub-total=	45.92%
K=	1.278%	Na=	3.476%
Ni=	0.038%	Zr=	0.041%

Sub-total =	95.058%	Sub-total=	86.978%
K2O=	1.538%	Na2O=	4.686%
NiO=	0.038%	ZrO2=	0.055%

10.0

Total=	96.62%	Total=	91.71%	94.2%
Total=	82.87%	Total=	49.44%	

11.0 Note: The KOH fusion is performed in a nickel metal crucible. Thus potassium and nickel reported are values obtained from the Na2O2/Zr fusion.
The Na and Zr reported on the Na2O2/Zr crucible are values obtained from the KOH fusion using the nickel crucible.

12.0 Comment: At low concentration of Ca, the Na2O2 fusion is not included in the average value.
Negative values reported in this procedure are at or below the estimated detection limit for the ICP/AES procedure.

13.0 Calculated by and date: [signature] 12/17/03

14.0 Approved by and date:

TCLP for Rad Samples : 100Soil; 300Soil; 100SFR 1,3+3; 300SFR 1,2,+3

Analysis Report Fri 12-03-93 04:15:53 PM page 1

Method: GEN Sample Name: blank Operator: gaw
Run Time: 12/03/93 16:14:28
Comment: as a sample
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0016	.0162	.0121	.0018	.0001	.0063	.3845
SDev	.0007	.0029	.0005	.0002	.0001	.0050	.0038
%RSD	42.36	18.15	4.445	8.882	60.88	79.42	.9826
#1	.0024	.0195	.0127	.0019	.0001	.0099	.3882
#2	.0011	.0140	.0116	.0019	.0001	.0006	.3806
#3	.0015	.0150	.0121	.0016	.0002	.0084	.3847

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0006	.0153	.0021	.0020	.0009	.0017	.0006
SDev	.0010	.0053	.0008	.0010	.0003	.0004	.0002
%RSD	156.2	34.78	36.48	48.48	38.49	23.97	26.65
#1	.0003	.0213	.0026	.0031	.0011	.0021	.0008
#2	-.0002	.0128	.0026	.0013	.0011	.0016	.0005
#3	.0017	.0116	.0012	.0015	.0005	.0013	.0005

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0081	.6942	.0028	.0038	.0884	.0005	.0037
SDev	.0011	.1452	.0008	.0004	.0066	.0001	.0011
%RSD	13.09	20.92	29.42	10.91	7.485	24.74	29.33
#1	.0090	.8526	.0038	.0038	.0960	.0005	.0037
#2	.0069	.6625	.0022	.0043	.0839	.0005	.0026
#3	.0083	.5674	.0024	.0034	.0854	.0003	.0048

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	489.2	475.9	.0490	.0128	.0726	.0278	.0882
SDev	5.5	2.9	.0036	.0032	.0066	.0078	.0037
%RSD	1.117	.6189	7.313	24.69	9.062	28.07	4.183
#1	483.3	472.5	.0530	.0164	.0754	.0358	.0916
#2	494.1	477.7	.0480	.0117	.0650	.0276	.0843
#3	490.2	477.5	.0460	.0103	.0773	.0202	.0886

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.0341	.0669	.0055	.0169	-.0010	.0016	.0004
SDev	.0044	.0028	.0001	.0078	.0003	.0005	.0002
%RSD	12.81	4.145	1.732	46.30	32.48	32.59	38.49
#1	.0385	.0682	.0055	.0255	-.0012	.0023	.0006
#2	.0298	.0688	.0054	.0151	-.0012	.0013	.0003
#3	.0340	.0637	.0055	.0102	-.0006	.0013	.0003

Elem	Zn2138	Zr3391
Avge	.0076	-.0022
SDev	.0005	.0003
%RSD	6.145	11.76
#1	.0078	-.0019
#2	.0070	-.0022
#3	.0079	-.0024

9413276.0833

Analysis Report Fri 12-03-93 04:02:32 PM page 1

Method: GEN Sample Name: blank Operator: gaw
Run Time: 12/03/93 16:01:06
Comment: as a sample
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0007	.0036	.0094	.0016	-.0001	-.0056	.3724
SDev	.0004	.0014	.0009	.0001	.0001	.0074	.0025
%RSD	56.95	38.81	10.16	8.571	84.02	132.4	.6671
#1	.0007	.0044	.0089	.0015	-.0001	-.0009	.3703
#2	.0003	.0045	.0105	.0017	-.0002	-.0142	.3751
#3	.0011	.0020	.0088	.0016	-.0001	-.0017	.3717

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0008	.0094	.0005	.0001	.0000	.0009	.0004
SDev	.0005	.0008	.0007	.0001	.0003	.0001	.0001
%RSD	60.00	8.221	155.7	87.62	9697000.	17.56	37.50
#1	.0003	.0100	-.0001	.0002	-.0004	.0010	.0002
#2	.0012	.0096	.0012	-.0000	.0002	.0008	.0004
#3	.0008	.0085	.0002	.0002	.0002	.0008	.0005

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0032	.5131	.0010	.0038	.0763	.0001	.0006
SDev	.0003	.0240	.0002	.0001	.0039	.0001	.0015
%RSD	11.19	4.669	21.78	3.208	5.121	173.2	239.1
#1	.0028	.4859	.0009	.0038	.0749	-.0001	.0021
#2	.0035	.5312	.0009	.0036	.0733	.0001	.0007
#3	.0032	.5221	.0013	.0038	.0807	.0001	-.0009

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	486.4	470.3	.0406	.0070	.0621	-.0013	.0794
SDev	4.3	1.0	.0022	.0012	.0022	.0011	.0046
%RSD	.8937	.2199	5.538	16.82	3.582	88.59	5.759
#1	491.3	471.5	.0396	.0079	.0616	-.0000	.0749
#2	482.9	470.1	.0431	.0075	.0645	-.0022	.0841
#3	485.0	469.4	.0390	.0056	.0601	-.0015	.0791

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.0273	.0629	.0052	.0103	-.0017	.0006	.0002
SDev	.0027	.0045	.0000	.0073	.0000	.0002	.0001
%RSD	9.939	7.092	.0000	70.34	.0000	28.94	34.64
#1	.0302	.0593	.0052	.0026	-.0017	.0007	.0002
#2	.0268	.0679	.0052	.0171	-.0017	.0004	.0002
#3	.0248	.0615	.0052	.0113	-.0017	.0007	.0003

Elem	Zn2138	Zr3391
Avge	.0062	-.0030
SDev	.0001	.0001
%RSD	1.202	4.961
#1	.0062	-.0032
#2	.0062	-.0029
#3	.0061	-.0029

AW 3276-0834

Analysis Report Fri 12-03-93 03:56:32 PM page 1

Method: GEN Sample Name: 100 area soil Operator: gaw
Run Time: 12/03/93 15:55:07
Comment: 5.1gram sample weight 100grams eff 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0029	.0786	.0179	.1572	.0002	.0045	33.58
SDev	.0008	.0070	.0017	.0006	.0000	.0136	.25
%RSD	28.91	8.904	9.428	.3805	1.215	299.9	.7560
#1	.0023	.0755	.0193	.1569	.0002	-.0059	33.31
#2	.0039	.0866	.0183	.1568	.0002	.0199	33.82
#3	.0025	.0737	.0160	.1579	.0002	-.0004	33.61

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0032	.0582	.0031	.0128	.0065	.0044	.0013
SDev	.0012	.0077	.0008	.0009	.0005	.0005	.0001
%RSD	35.96	13.31	26.98	6.892	7.160	11.78	10.34
#1	.0031	.0536	.0032	.0119	.0060	.0044	.0012
#2	.0022	.0671	.0039	.0137	.0069	.0049	.0015
#3	.0045	.0538	.0022	.0128	.0066	.0039	.0013

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0099	2.437	.0108	.0059	2.636	.0922	.0040
SDev	.0007	.142	.0013	.0000	.008	.0004	.0009
%RSD	6.969	5.839	11.70	.0000	.2921	.4420	21.73
#1	.0092	2.310	.0098	.0059	2.635	.0917	.0037
#2	.0106	2.591	.0122	.0059	2.628	.0925	.0050
#3	.0099	2.410	.0104	.0059	2.643	.0923	.0034

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	476.9	463.2	.1051	.0304	.1383	.0231	.2302
SDev	3.6	2.2	.0028	.0026	.0122	.0078	.0033
%RSD	.7625	.4847	2.663	8.413	8.841	33.67	1.429
#1	480.1	463.9	.1023	.0274	.1260	.0191	.2264
#2	472.9	460.7	.1079	.0320	.1385	.0321	.2325
#3	477.7	465.0	.1050	.0317	.1504	.0182	.2318

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	1.983	.0767	.1170	.0444	-.0003	.0036	.0013
SDev	.011	.0032	.0005	.0097	.0002	.0008	.0001
%RSD	.5606	4.117	.4303	21.80	69.28	21.58	6.662
#1	1.971	.0782	.1171	.0537	-.0004	.0029	.0012
#2	1.988	.0731	.1165	.0451	-.0001	.0044	.0014
#3	1.991	.0788	.1174	.0344	-.0004	.0035	.0012

Elem	Zn2138	Zr3391
Avge	.0446	-.0003
SDev	.0004	.0004
%RSD	.8194	131.8
#1	.0449	-.0004
#2	.0447	.0001
#3	.0442	-.0006

Analysis Report Fri 12-03-93 04:27:19 PM page 1

Method: GEN Sample Name: 100 sfr 1 Operator: gaw
Run Time: 12/03/93 16:25:54
Comment: 5.0 grams sample wt. 100.eff 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0029	.1162	.0130	.0040	.0001	.0020	.5497
SDev	.0004	.0103	.0017	.0003	.0001	.0115	.0060
%RSD	15.58	8.870	12.87	8.678	62.15	563.7	1.095
#1	.0034	.1270	.0148	.0037	.0001	.0153	.5430
#2	.0026	.1153	.0126	.0039	.0001	-.0058	.5513
#3	.0026	.1064	.0115	.0043	.0002	-.0034	.5547

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0006	.0225	.0034	.0037	.0041	.0024	.0008
SDev	.0003	.0025	.0005	.0003	.0003	.0004	.0000
%RSD	43.31	11.06	15.27	9.179	7.317	16.46	.0000
#1	.0008	.0253	.0039	.0038	.0044	.0029	.0008
#2	.0003	.0216	.0029	.0033	.0038	.0023	.0008
#3	.0008	.0206	.0032	.0040	.0041	.0021	.0008

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0476	.9190	.0045	.0044	.1139	.0020	.0043
SDev	.0005	.0484	.0004	.0003	.0049	.0001	.0006
%RSD	.9705	5.267	8.498	7.274	4.296	5.774	14.47
#1	.0480	.9749	.0045	.0047	.1167	.0021	.0051
#2	.0476	.8888	.0049	.0040	.1167	.0019	.0040
#3	.0471	.8934	.0041	.0045	.1082	.0019	.0040

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	481.9	472.0	.0545	.0128	.0750	.0196	.0797
SDev	4.4	1.1	.0028	.0042	.0063	.0059	.0042
%RSD	.9080	.2267	5.052	32.33	8.421	30.14	5.311
#1	478.2	470.8	.0571	.0118	.0787	.0250	.0750
#2	480.7	472.5	.0549	.0093	.0787	.0206	.0832
#3	486.7	472.8	.0516	.0174	.0677	.0133	.0810

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.1835	.0682	.0062	.0272	.0005	.0029	.0006
SDev	.0009	.0021	.0000	.0092	.0003	.0003	.0001
%RSD	.4717	3.052	.0000	33.69	50.92	10.71	23.08
#1	.1840	.0701	.0062	.0262	.0008	.0032	.0006
#2	.1840	.0685	.0062	.0368	.0005	.0026	.0008
#3	.1825	.0660	.0062	.0186	.0003	.0029	.0005

Elem	Zn2138	Zr3391
Avge	.0100	-.0016
SDev	.0005	.0003
%RSD	5.251	18.84
#1	.0104	-.0014
#2	.0103	-.0014
#3	.0094	-.0019

9413276.0036

Analysis Report Fri 12-03-93 04:14:01 PM page 1

Method: GEN Sample Name: 100 sfr 2 Operator: gaw
Run Time: 12/03/93 16:12:36
Comment: 5.1 grams sample wt. 100. eff 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0020	.0693	.0128	.0037	.0002	.0002	.6341
SDev	.0014	.0055	.0011	.0002	.0000	.0043	.0097
%RSD	66.40	7.917	8.852	6.495	1.514	2164.	1.537
#1	.0036	.0757	.0137	.0039	.0002	-.0027	.6428
#2	.0011	.0660	.0132	.0035	.0002	.0052	.6236
#3	.0015	.0663	.0115	.0035	.0002	-.0019	.6360

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0003	.0171	.0026	.0029	.0061	.0017	.0006
SDev	.0000	.0073	.0009	.0018	.0007	.0010	.0003
%RSD	.0025	42.73	34.47	61.07	11.55	57.02	48.04
#1	.0003	.0255	.0036	.0049	.0069	.0029	.0009
#2	.0003	.0134	.0022	.0015	.0057	.0013	.0005
#3	.0003	.0123	.0019	.0022	.0057	.0010	.0004

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.2136	.8194	.0030	.0041	.1183	.0035	.0038
SDev	.0016	.3044	.0017	.0002	.0069	.0002	.0013
%RSD	.7567	37.15	56.79	5.871	5.849	5.660	35.34
#1	.2136	1.170	.0049	.0043	.1262	.0037	.0053
#2	.2120	.6715	.0021	.0038	.1135	.0035	.0029
#3	.2153	.6172	.0019	.0043	.1151	.0033	.0032

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	475.7	471.1	.0517	.0115	.0693	.0256	.0904
SDev	3.1	4.1	.0066	.0008	.0070	.0062	.0060
%RSD	.6498	.8770	12.84	7.293	10.16	24.15	6.602
#1	472.1	466.9	.0594	.0107	.0734	.0317	.0960
#2	477.4	471.3	.0485	.0124	.0734	.0258	.0841
#3	477.5	475.1	.0473	.0114	.0612	.0194	.0910

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.1998	.0658	.0062	.0390	.0005	.0021	.0005
SDev	.0078	.0027	.0000	.0080	.0005	.0010	.0003
%RSD	3.920	4.082	.0000	20.59	99.22	48.26	51.96
#1	.2088	.0685	.0062	.0364	.0010	.0032	.0008
#2	.1962	.0660	.0062	.0327	.0001	.0013	.0003
#3	.1943	.0631	.0062	.0481	.0003	.0016	.0003

Elem	Zn2138	Zr3391
Avge	.0102	-.0020
SDev	.0004	.0010
%RSD	4.249	48.58
#1	.0107	-.0009
#2	.0099	-.0024
#3	.0100	-.0027

9417276.0837

Analysis Report Fri 12-03-93 04:22:19 PM page 1

Method: GEN Sample Name: 100 sfr 3 Operator: gaw
Run Time: 12/03/93 16:20:53
Comment: 5.1 grams sample wt. 99.8 eff 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0030	.0738	.0157	.0036	.0001	.0150	.5143
SDev	.0007	.0011	.0003	.0001	.0000	.0051	.0042
%RSD	23.32	1.489	2.055	2.193	1.265	33.78	.8067
#1	.0024	.0750	.0159	.0037	.0001	.0098	.5182
#2	.0038	.0736	.0154	.0037	.0001	.0153	.5148
#3	.0028	.0729	.0159	.0035	.0001	.0200	.5100

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0011	.0231	.0030	.0041	.0054	.0023	.0008
SDev	.0007	.0012	.0010	.0003	.0003	.0003	.0001
%RSD	65.48	5.372	34.00	8.362	5.660	11.21	17.65
#1	.0017	.0224	.0039	.0044	.0057	.0021	.0006
#2	.0012	.0246	.0032	.0038	.0054	.0026	.0009
#3	.0003	.0224	.0019	.0040	.0051	.0023	.0008

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.1329	.9643	.0043	.0043	.1126	.0025	.0038
SDev	.0013	.0883	.0009	.0004	.0031	.0000	.0006
%RSD	.9570	9.156	20.52	8.518	2.756	.0000	14.92
#1	.1314	.9658	.0038	.0038	.1114	.0025	.0042
#2	.1335	1.052	.0053	.0045	.1161	.0025	.0032
#3	.1337	.8753	.0038	.0045	.1103	.0025	.0040

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	482.3	472.3	.0551	.0176	.0883	.0339	.0939
SDev	6.9	.7	.0031	.0030	.0105	.0012	.0061
%RSD	1.437	.1382	5.586	17.09	11.89	3.608	6.453
#1	474.7	471.6	.0531	.0192	.0762	.0353	.0912
#2	484.2	472.5	.0586	.0194	.0944	.0336	.1009
#3	488.1	472.9	.0536	.0141	.0944	.0329	.0897

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.1804	.0690	.0062	.0219	.0012	.0026	.0007
SDev	.0019	.0018	.0000	.0150	.0002	.0003	.0001
%RSD	1.060	2.641	.0000	68.36	18.23	12.04	12.37
#1	.1802	.0685	.0062	.0328	.0010	.0023	.0006
#2	.1824	.0675	.0062	.0048	.0014	.0026	.0008
#3	.1786	.0710	.0062	.0280	.0010	.0029	.0006

Elem	Zn2138	Zr3391
Avge	.0096	-.0016
SDev	.0003	.0003
%RSD	2.819	19.00
#1	.0098	-.0014
#2	.0097	-.0014
#3	.0093	-.0019

9417274.0830

Analysis Report Fri 12-03-93 04:24:29 PM page 1

Method: GEN Sample Name: 300 area soil Operator: gaw
Run Time: 12/03/93 16:23:04
Comment: 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0132	2.361	.0263	3.195	.0006	.0214	43.78
SDev	.0010	.053	.0016	.003	.0001	.0040	.16
%RSD	7.223	2.235	6.023	.1073	15.14	18.69	.3623
#1	.0126	2.308	.0254	3.191	.0005	.0180	43.74
#2	.0143	2.361	.0282	3.196	.0007	.0258	43.95
#3	.0128	2.413	.0254	3.198	.0005	.0203	43.64

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0032	.1047	.0085	.0417	.6330	.0064	.0025
SDev	.0003	.0019	.0010	.0009	.0016	.0003	.0001
%RSD	8.245	1.768	11.40	2.142	.2533	4.770	3.208
#1	.0031	.1051	.0080	.0409	.6318	.0062	.0024
#2	.0035	.1063	.0096	.0427	.6324	.0067	.0026
#3	.0031	.1027	.0080	.0416	.6348	.0062	.0024

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.0229	2.719	.0215	.0056	4.875	.0929	.0086
SDev	.0003	.152	.0010	.0005	.006	.0003	.0013
%RSD	1.537	5.585	4.585	9.437	.1274	.3649	14.54
#1	.0226	2.623	.0208	.0055	4.870	.0927	.0083
#2	.0233	2.894	.0226	.0061	4.872	.0933	.0099
#3	.0229	2.641	.0211	.0051	4.882	.0927	.0075

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	483.4	478.6	.1300	.0768	.1171	.0607	.2575
SDev	4.1	1.3	.0013	.0048	.0009	.0098	.0055
%RSD	.8475	.2624	1.024	6.225	.7799	16.12	2.141
#1	485.3	479.0	.1293	.0741	.1177	.0540	.2541
#2	478.7	477.2	.1315	.0824	.1160	.0719	.2639
#3	486.3	479.6	.1292	.0740	.1175	.0562	.2546

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	11.59	.0951	.3123	.0676	.0019	.0094	.0030
SDev	.00	.0053	.0005	.0139	.0003	.0003	.0002
%RSD	.0374	5.577	.1612	20.53	16.24	3.281	5.773
#1	11.59	.1007	.3119	.0597	.0018	.0094	.0029
#2	11.59	.0943	.3129	.0596	.0023	.0097	.0032
#3	11.58	.0902	.3122	.0837	.0018	.0091	.0029

Elem	Zn2138	Zr3391
Avge	.0312	.0031
SDev	.0003	.0004
%RSD	.8746	12.55
#1	.0313	.0032
#2	.0314	.0035
#3	.0309	.0027

Analysis Report — Fri 12-03-93 04:09:16 PM — page 1

Method: GEN — Sample Name: 300 sfr 1 — Operator: gaw
Run Time: 12/03/93 16:07:51
Comment: 5.0 grams sample wt. 99.9 eff 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0014	.0594	.0159	.0047	.0000	-.0036	.5268
SDev	.0004	.0023	.0000	.0003	.0001	.0056	.0034
%RSD	31.99	3.901	.0980	6.063	190.5	157.4	.6549
#1	.0009	.0567	.0160	.0046	-.0001	-.0051	.5231
#2	.0016	.0609	.0159	.0050	.0001	-.0083	.5299
#3	.0016	.0606	.0159	.0045	.0001	.0027	.5272

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0002	.0148	.0018	.0018	.0251	.0014	.0006
SDev	.0005	.0020	.0004	.0009	.0005	.0007	.0001
%RSD	346.6	13.23	21.63	49.97	2.095	47.79	14.43
#1	-.0002	.0129	.0016	.0011	.0244	.0008	.0005
#2	-.0002	.0168	.0022	.0029	.0254	.0021	.0006
#3	.0008	.0148	.0016	.0015	.0254	.0013	.0005

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.3961	.7198	.0027	.0040	.1038	.0048	.0022
SDev	.0031	.1633	.0009	.0003	.0077	.0001	.0008
%RSD	.7886	22.69	34.67	8.040	7.431	2.373	38.57
#1	.3929	.5629	.0021	.0036	.0976	.0046	.0023
#2	.3963	.8888	.0038	.0040	.1124	.0048	.0029
#3	.3991	.7078	.0022	.0043	.1013	.0048	.0012

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	482.6	471.6	.0477	.0127	.0798	.0130	.0857
SDev	.7	1.7	.0044	.0008	.0063	.0103	.0060
%RSD	.1376	.3664	9.334	6.387	7.848	79.86	7.003
#1	482.1	470.8	.0445	.0121	.0775	.0052	.0788
#2	482.4	470.5	.0528	.0136	.0869	.0247	.0899
#3	483.4	473.6	.0458	.0123	.0750	.0090	.0882

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2212	.0677	.0061	.0168	.0008	.0016	.0005
SDev	.0044	.0033	.0001	.0018	.0002	.0008	.0001
%RSD	1.983	4.919	1.560	10.96	21.43	49.71	30.00
#1	.2161	.0714	.0060	.0149	.0007	.0007	.0003
#2	.2237	.0666	.0062	.0186	.0010	.0023	.0006
#3	.2238	.0650	.0060	.0168	.0008	.0020	.0005

Elem	Zn2138	Zr3391
Avge	.0172	-.0023
SDev	.0007	.0006
%RSD	3.921	25.31
#1	.0166	-.0027
#2	.0179	-.0017
#3	.0171	-.0027

SW-8274.0840

Analysis Report Fri 12-03-93 04:00:16 PM page 1

Method: GEN Sample Name: 300 sfr 2 Operator: gaw
Run Time: 12/03/93 15:58:51
Comment: 5.3gram sample weight 100.1grams eff 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0009	.0499	.0130	.0086	-.0001	-.0089	.6162
SDev	.0005	.0032	.0017	.0001	.0001	.0049	.0010
%RSD	58.77	6.368	12.93	.9164	83.76	55.76	.1706
#1	.0013	.0507	.0148	.0086	-.0001	-.0060	.6174
#2	.0011	.0464	.0126	.0087	-.0002	-.0060	.6160
#3	.0003	.0525	.0115	.0086	-.0001	-.0146	.6153

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0005	.0115	.0008	.0015	.0326	.0011	.0004
SDev	.0010	.0031	.0005	.0002	.0000	.0001	.0001
%RSD	208.1	26.75	65.62	14.35	.0000	13.16	19.25
#1	-.0006	.0114	.0002	.0015	.0326	.0010	.0004
#2	.0012	.0146	.0012	.0013	.0326	.0013	.0005
#3	.0008	.0085	.0009	.0018	.0326	.0010	.0004

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.1892	.6821	.0019	.0037	.1206	.0035	.0022
SDev	.0013	.0577	.0004	.0001	.0019	.0000	.0006
%RSD	.6800	8.456	19.47	3.268	1.541	.0000	25.34
#1	.1878	.7485	.0023	.0038	.1204	.0035	.0018
#2	.1894	.6534	.0020	.0036	.1225	.0035	.0029
#3	.1903	.6444	.0016	.0036	.1188	.0035	.0021

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	479.4	465.5	.0436	.0066	.0530	.0076	.0893
SDev	3.6	2.2	.0021	.0004	.0041	.0058	.0106
%RSD	.7468	.4783	4.794	6.241	7.699	76.49	11.93
#1	475.4	464.5	.0460	.0071	.0527	.0035	.0979
#2	480.1	464.0	.0422	.0065	.0571	.0050	.0925
#3	482.5	468.1	.0427	.0063	.0490	.0142	.0773

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.1887	.0580	.0062	.0206	.0003	.0011	.0003
SDev	.0027	.0061	.0000	.0116	.0000	.0004	.0000
%RSD	1.438	10.48	.0000	56.63	.0000	31.57	.0000
#1	.1917	.0644	.0062	.0074	.0003	.0013	.0003
#2	.1863	.0574	.0062	.0295	.0003	.0013	.0003
#3	.1882	.0523	.0062	.0247	.0003	.0007	.0003

Elem	Zn2138	Zr3391
Avge	.0240	-.0027
SDev	.0001	.0000
%RSD	.5589	.0519
#1	.0242	-.0027
#2	.0239	-.0027
#3	.0240	-.0027

AW 9276.0841

Analysis Report Fri 12-03-93 04:11:48 PM page 1

Method: GEN Sample Name: 300 sfr 3 Operator: gaw
Run Time: 12/03/93 16:10:23
Comment: 5.13grams sample wt. 100.2 eff 3x
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	B_2496	Ba4934	Be3130	Bi2230	Ca3179
Avge	.0019	.0608	.0137	.0054	.0001	.0032	.6355
SDev	.0015	.0048	.0009	.0002	.0000	.0112	.0089
%RSD	81.25	7.880	6.842	2.961	3.746	351.9	1.393
#1	.0020	.0606	.0132	.0054	.0001	.0089	.6380
#2	.0034	.0657	.0148	.0054	.0001	.0104	.6428
#3	.0003	.0562	.0132	.0052	.0001	-.0098	.6257

Elem	Cd2288	Ce4186	Co2286	Cr2677	Cu3247	Dy3531	Eu3819
Avge	.0006	.0153	.0025	.0024	.0185	.0016	.0005
SDev	.0007	.0095	.0011	.0016	.0005	.0009	.0003
%RSD	114.6	61.88	43.82	65.58	2.504	60.09	54.55
#1	.0008	.0160	.0029	.0029	.0184	.0018	.0005
#2	-.0002	.0245	.0032	.0038	.0190	.0023	.0008
#3	.0012	.0055	.0012	.0007	.0181	.0005	.0002

Elem	Fe2599	K_7664	La3988	Li6707	Mg2790	Mn2576	Mo2020
Avge	.1727	.6942	.0027	.0040	.1229	.0032	.0029
SDev	.0006	.3166	.0018	.0002	.0089	.0002	.0013
%RSD	.3362	45.61	67.35	5.172	7.288	7.070	43.34
#1	.1721	.8074	.0029	.0040	.1252	.0031	.0031
#2	.1732	.9386	.0044	.0043	.1304	.0035	.0040
#3	.1728	.3365	.0008	.0038	.1130	.0031	.0015

Elem	Na5889	Na3302	Nd4061	Ni2316	P_1782	Pb2203	S_1820
Avge	487.2	473.3	.0472	.0113	.0591	.0139	.0991
SDev	3.4	2.6	.0070	.0010	.0076	.0082	.0047
%RSD	.7007	.5418	14.83	9.105	12.80	58.89	4.702
#1	488.1	471.9	.0496	.0102	.0609	.0081	.1042
#2	483.4	471.7	.0527	.0114	.0508	-.0233	.0977
#3	490.0	476.2	.0393	.0123	.0656	.0103	.0952

Elem	Si2881	Sn1899	Sr4215	Te2142	Ti3349	V_2924	Y_3710
Avge	.2111	.0678	.0062	.0165	.0007	.0019	.0004
SDev	.0078	.0029	.0000	.0105	.0004	.0009	.0002
%RSD	3.713	4.233	.0000	63.68	52.04	50.94	50.92
#1	.2134	.0650	.0062	.0200	.0008	.0016	.0005
#2	.2176	.0707	.0062	.0247	.0010	.0029	.0006
#3	.2024	.0676	.0062	.0047	.0003	.0010	.0002

Elem	Zn2138	Zr3391
Avge	.0198	-.0022
SDev	.0003	.0006
%RSD	1.401	26.15
#1	.0194	-.0019
#2	.0200	-.0019
#3	.0199	-.0029

94132764.0842

9413276.0843

DATA REPORT (Supplemental) 1/ 21/ 94
PNL Analytical Chemistry Lab.
Radioanalytical Group, 325 Building

Client: R Merrill
WP #: ED4180

Cognizant scientist: T O Harvey Date: 1/21/94
Reviewer: Pa Poppe Date: 1/21/94

ALO #	Customer ID	Uranium ug/g	Co-60 pCi/L	Cs-137 pCi/L	Eu-152 pCi/L	Eu-154 pCi/L	Total Alpha pCi/L	Total Beta pCi/L as Sr90
94-1918	100 Area Soil		< 56	37 +/- 42%	200 +/- 13%	< 90	< 20	250 +\-16%
94-1919	100 SFR1*							
94-1920	100 SFR2*		< 10	< 10	< 10	< 10	< 35	< 80
94-1921	100 SFR3*							
94-1922	300 Area Soil	1.81E+2						
94-1923	300 SFR1	3.81E-2						
94-1924	300 SFR2	8.98E-2						
94-1925	300 SFR3	6.44E-2						
94-1926	blank	< 4E-5 ug/ml	< 140 **	< 80	< 390	< 220		

* These were combined and analyzed as a single sample.

** Blank GEA minium detectable activities are higher than sample activities due to a shorter counting time. This approach allowed us to meet the requested report schedule.

9413276.0844

DATA REPORT
PNL Analytical Chemistry Lab.
Radioanalytical Group, 325 Building

12/ 14/ 93

Analysis of TCLP Leachate

Client: R Merrill
WP #: ED4180

Cognizant scientist: E O Harvey Date: 12/14/93

Reviewer: [signature] Date: 12/14/93

ALO #	Customer ID	Uranium ug/g	Co-60 pCi/L	Cs-137 pCi/L	Eu-152 pCi/L	Eu-154 pCi/L
				39, 15%	.7%	
94-1918	100 Area Soil		< 56	37 +/- 42%	200 +/- 13%	< 90
94-1919	100 SFR1*					
94-1920	100 SFR2*		< ~~10~~ 4	< ~~18~~ 4	< ~~10~~ 17	< ~~10~~
94-1921	100 SFR3*				↑ Energy line used is lower energy, higher background	↑ lower abundance
94-1922	300 Area Soil	1.81E+2				
94-1923	300 SFR1	3.81E-2				
94-1924	300 SFR2	8.98E-2				
94-1925	300 SFR3	6.44E-2				
94-1926	blank	< 4E-5 ug/ml	** < 140	< 80	< 390	< 220

Per phone conversation with Shannon Thompson 1/4/93 updated due to final calibration of the detector [illegible] 1/4/93

mass %			
U234	U235	U238	U239
.0055	.7248	.0028	99.2634

* These were combined and analyzed as a single sample.

** Blank GEA minium detectable activities are higher than sample activities due to a shorter counting time. This approach allowed us to meet the requested report schedule.

DATA REPORT (SUPPLEMENTAL)
PNL Analytical Chemistry Lab.
Radioanalytical Group, 325 Building

Analysis of TCLP Leachate

12/ 17/ 93

Client: R Merrill
WP #: ED4180

Cognizant scientist: L O Harvey Date: 12/17/93
Reviewer: F A Poppiti Date: 12/27/93

ALO #	Customer ID	URANIUM ISOTOPICS MASS % U-234	U-235	U-236	U-238
94-1922	300 Area Soil	0.0055	0.7286	0.0025	99.2634

Viscosity
100 Area Rad Melt

100 SFR

VISCOSITY DATA: ~~FERNALD~~ GLASS
DATE: OCT 20, 1993
OPERATOR: KMO
SAMPLE:
FILE NAME FER-V
SPINDLE FACTOR: 10.32

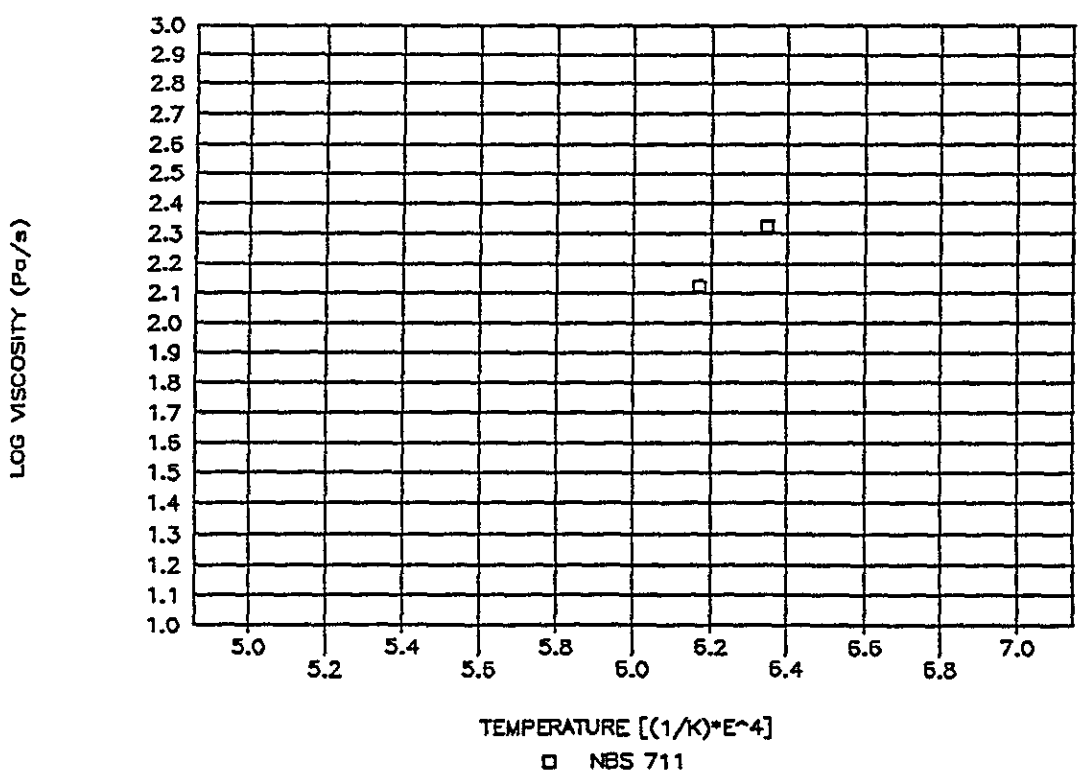
TEMPERATURE CENTIGRADE	1/K xE4	READ.	SPEED	VISCOSITY Pa/s	LOG VISCOSITY
1348	6.17	77.2	0.60	132.78	2.123
1303	6.35	61.1	0.30	210.18	2.323

9417276.0846

100 SFR

Viscosity: ~~FERNALD~~

OCT 20,1993 KMO



CALIBRATION OF VISCOMETER
USING NBS #711 REFERENCE GLASS

OCTOBER 20, 1993 Lotus File: NB102093
KMO
Furnace #RAD
Spindle #2

TEMP oC	READ	SPEED	THEOR. VISC	CALC SPINDLE FACTOR	OBS VISC	PERCENT ERROR
1337	56.60	6.0	93.27	9.89	97	4.19
1243	53.55	3.0	190.16	10.65	184	-3.23
1150	63.70	1.5	439.14	10.34	438	-0.20
1054	72.05	0.6	1248.62	10.40	1239	-0.76
			AVE.=	10.32		

9417276.0847

VISCOSITY DATA: NBS 711 Calibration Run
Spindle #2

SAMPLE:NBS711 OCTOBER 20, 1993 SPINDLE FACTOR: 10.32

TEMPERATURE oC	1/KxE4	READ	SPEED	POISE	EST.VISC. NBS CURVE	PERCENT ERROR		
1337	6.21	56.60	6.00	97	93	4.19	1.99	1.97
1243	6.60	53.55	3.00	184	190	-3.23	2.27	2.28
1150	7.03	63.70	1.50	438	439	-0.20	2.64	2.64
1054	7.54	72.05	0.60	1239	1249	-0.76	3.09	3.10

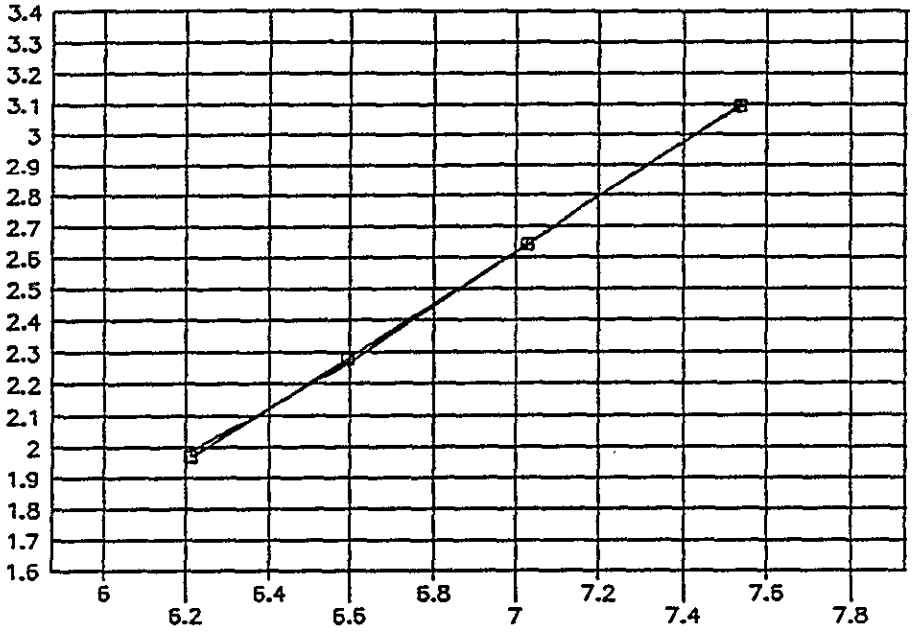
The viscosity set-up has been calibrated as a system.
The following is a list of integral parts of the system:

Viscometer #2
T/C # 999-78-02-055 #121
Furnace #RAD
Spindle #2
Omega T/C Readout, Cal# 364-35-03-001

DH#2276.0848

VISCOSITY CALIBRATION

10/20/93 SPINDLE FACTOR = 10.32 KMO



ELECTRICAL CONDUCTIVIY OF ~~FERNALD~~ 100SFR GLASS

LOTUS FILE NAME: FER-E

Probe #: 7

Date: OCT 18, 1993

Operator: KMO

Sample: FERNALD

R Correction Factor and Calibration:
(See BNW 53669 p. 137 and 138)

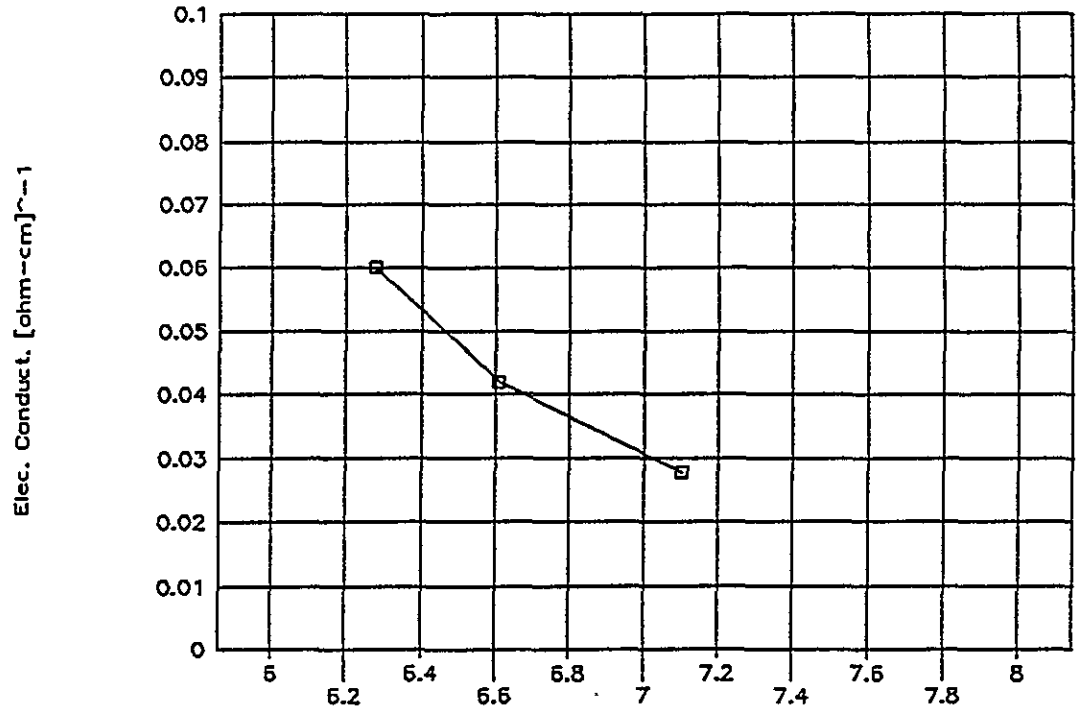
Raw Data Averaged

Furnace Setting	Temp (C)	Temp Average	Resist. (ohms)	Average R(ohms)
1350	1319		8.200	
	1320		8.190	
	1321		8.170	
		1320		8.187
1250	1248		11.570	
	1238		11.630	
	1233	1240	11.610	11.603
1150	1136		17.480	
	1135		17.470	
	1134	1135	17.460	17.470

PNL-3276.0049

100SFR
~~FERNALD~~ ELEC COND 10/18/93

CELL CONSTANT=0.477 KMO



ELECTRICAL CONDUCTIVITY CALIBRATION (LCR METER)
NOTE: Special calibration with probes 1/4" into melt.
Probe #: 7
Date: 18-Oct-93
Operator KMO Furnace: RAD
Sample: NBS 711 T/C: 999-78-02-055 #121

TABLE IV. Raw Data Averaged

Furnace Setting	Temp (C)	Temp Average	Resist. (ohms)	Average R(ohms)
1350	1324		5.44	
	1325		5.44	
	1326	1325	5.43	5.44
1250	1245		8.39	
	1237	1239	8.36	8.38
	1234		8.30	
1150	1139		14.27	
	1138	1138	14.24	14.26
	1137		14.24	
1050	1046		28.70	
	1043		28.30	
	1041	1043	28.10	28.37
950	956		69.40	
	949	948	67.50	66.92
	946		66.50	
	944		65.70	
	943		65.50	

Table V. Internal Resistance of Probe 7

Temperature (C)	Resistance
1350	0.201
1250	0.195
1150	0.188
1050	0.181
950	0.174

The E.C. set up has been calibrated as a system. The following is a list of integral parts of the system:

E.C. Probe #7
T/C # 999-78-02-055 #121, cal 6-9-92, due 6-9-94
T/C Readout: Cal# 364-79-06-023, cal 4-12-93, due 4-12-9
Calibration Block #2
Furnace # RAD

DSGD 9276.0850

ELECTRICAL CONDUCTIVIY CALIBRATION (LCR METER)

Probe #: 7 R correction factor: see Table V.
Date: 18-Oct-93
Operator KMO
Sample: NBS 711
Furnace: RAD T/C Identification: 999-78-02-055 #121

TABLE I. Calibration of Cell Constant Using National Bureau of Standards #711 Glass

Temp (C)	Temp (K)	Resistance (ohms)	R correct (ohms)	Theoretical L (ohm-cm)^-1	Theoretical Cell Constant
1325	1598	5.437	5.236	0.085	0.443
1239	1512	8.375	8.180	0.057	0.466
1138	1411	14.255	14.067	0.033	0.462
1043	1316	28.367	28.186	0.017	0.491
948	1221	66.920	66.746	0.008	0.522

Note: To calculate R correct, subtract the R correction factor from the resistance reading.

Avg. (X) 0.477
X = Cell Constant

TABLE II. Calibration Data Using Average Cell Constant

Cell Constant = 0.477

Temp (C)	Temp (K)	Temp 1/T(K)*10^4	Resistance (ohms)	R correct (ohms)	=Cell C/R cor. (L observed)
1325	1598	6.258	5.437	5.236	0.091
1239	1512	6.615	8.375	8.180	0.058
1138	1411	7.087	14.255	14.067	0.034
1043	1316	7.597	28.367	28.186	0.017
948	1221	8.193	66.920	66.746	0.007

TABLE III. Calculation of Percent Error

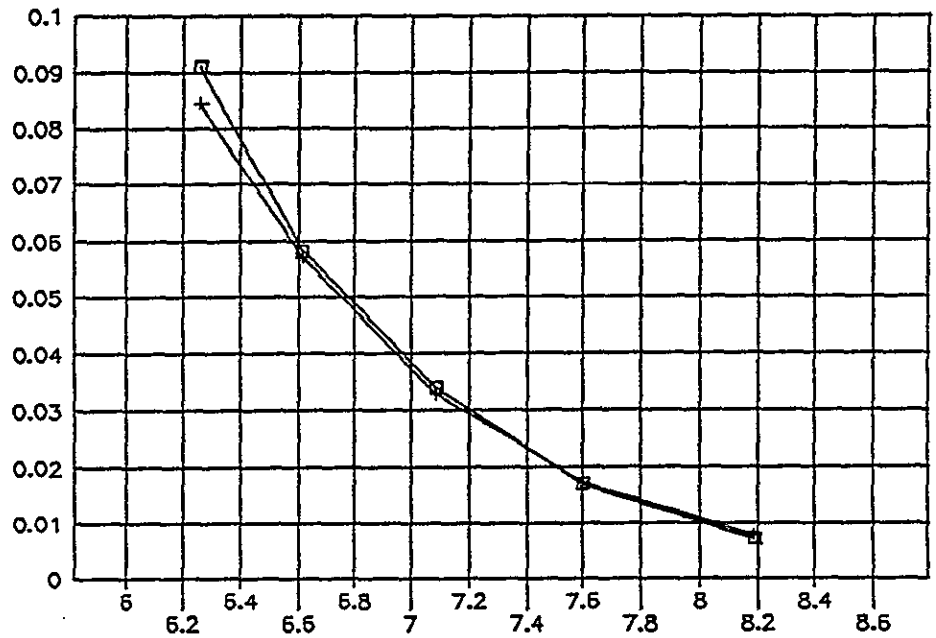
Temp (C)	Theoretical L (ohm-cm)^-1	Observed L (ohm-cm)^-1	Percent Error
1325	0.0846	0.0911	8
1239	0.0570	0.0583	2
1138	0.0329	0.0339	3
1043	0.0174	0.0169	-3
948	0.0078	0.0071	-9

9443776.0851

9W#9276.0852

NBS 711 CALIBRATION 10/18/93

Cell Constant=.477-1/4"in melt-KMO



Elec. Conduct. [ohm-cm]^-1

Temperature [1/T(K)*10^4]

□ Observed L

\+ Theoretical L

200 tons Soil Fines

VISCOSITY DATA: ~~FERNALD GLASS~~ 300 SFR
DATE: DEC 10, 1993
OPERATOR: KMO
SAMPLE: 300 SFR
FILE NAME SFR-V
SPINDLE FACTOR: 10.32

TEMPERATURE CENTIGRADE	1/K xE4	READ.	SPEED	VISCOSITY Pa/s	LOG VISCOSITY
1432	5.87	37.55	1.5	25.83	1.412
1406	5.96	40.70	1.5	28.00	1.447
1377	6.06	55.65	1.5	38.29	1.583
1320	6.28	39.15	0.6	67.34	1.828
1244	6.59	49.56	0.3	170.49	2.232
1238	6.62	55.25	0.3	190.06	2.279

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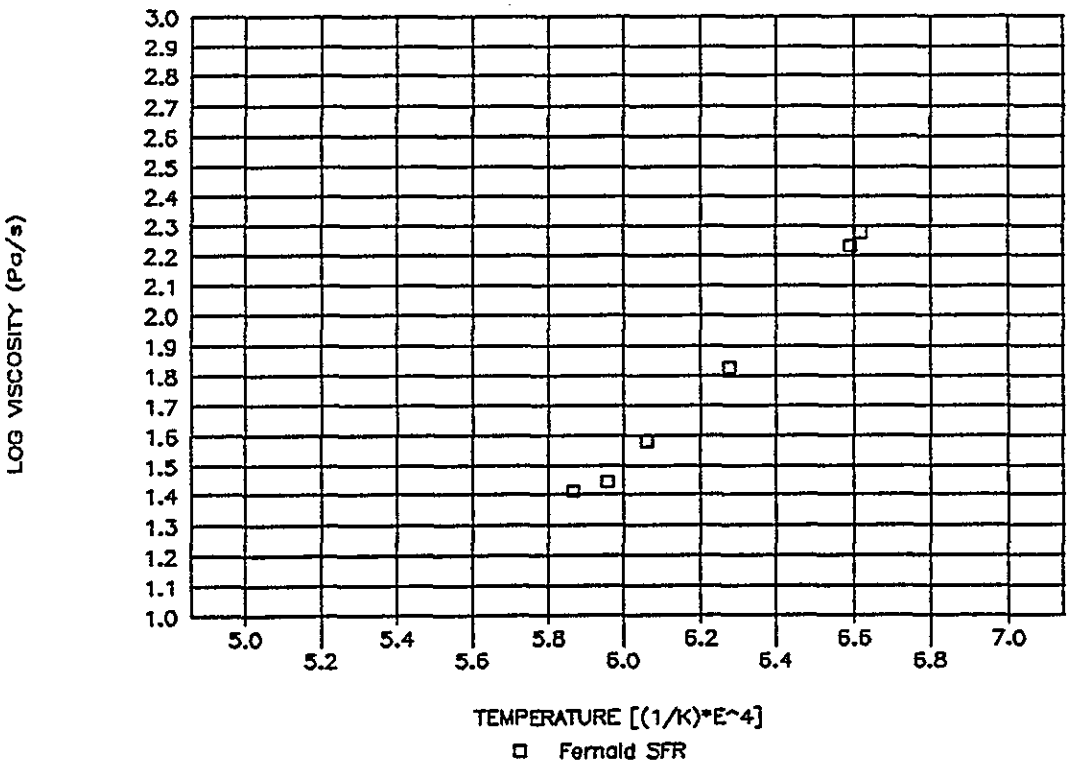
300 SFR

Viscosity: ~~FERNALD SRF~~

DEC 10,1993 KMO



ELECTRICAL CONDUCTIVIY OF ~~FERNALD SRF~~ 30 SFR GLASS
LOTUS FILE NAME: SFR-E
Probe #: 7
Date: DEC 14, 1993
Operator: KMO
Sample: FERNALD SFR

R Correction Factor and Calibration:
(See BNW 53669 p. 137 and 138)

Raw Data Averaged

Furnace Setting	Temp (C)	Temp Average	Resist. (ohms)	Average R(ohms)
1460	1433	1433	4.31	4.31
1360	1343		6.160	
	1342		6.160	
	1341		6.170	
		1342		6.163
1260	1247		8.990	
	1245		8.990	
	1245	1246	9.000	8.993
1160	1152		13.920	
	1151		13.920	
	1148	1150	13.910	13.917
1060	1052	1052	23.3	23.3
1430	1400	1400	4.85	4.85

ELECTRICAL CONDUCTIVIY OF ~~FERNALD SRF~~ 30 SFR GLASS
LOTUS FILE NAME: SFR-E
Probe #: 7
Date: DEC 14, 1993
Operator: KMO
Sample: FERNALD SFR

R correction Factor and Calibration:
(from BNW53669 p. 137 and 138)

Cell Constant = 0.477

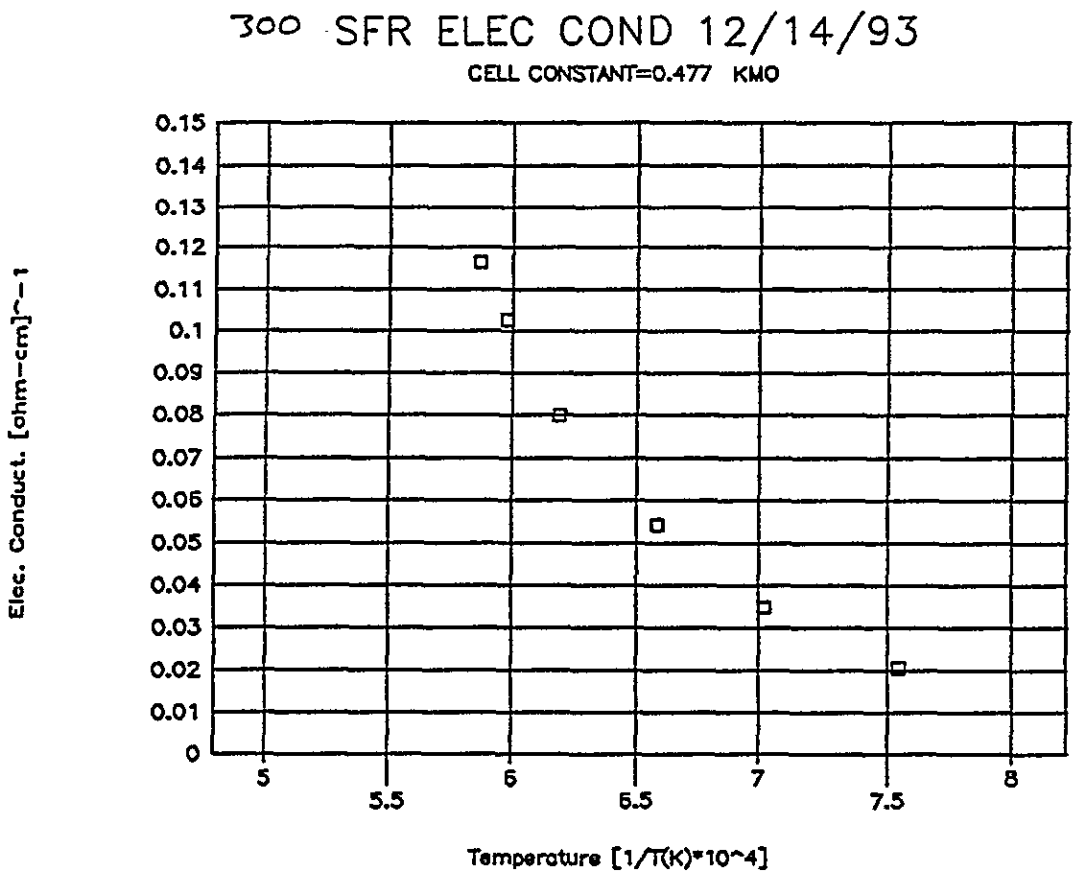
Temp (C)	Temp (K)	Temp 1/T(K)*10^4	Resistance (ohms)	R correct (ohms)	L=Cell C/R cor.
1433	1706	5.862	4.31	4.104	0.116
1342	1615	6.192	6.163	5.962	0.080
1246	1519	6.585	8.993	8.798	0.054
1150	1423	7.026	13.917	13.729	0.035
1052	1325	7.547	23.300	23.119	0.021
1400	1673	5.977	4.850	4.646	0.103

DW#274-0851

INTERNAL RESISTANCE MEASUREMENTS FOR PROBE #7
(SEE BNW 53669 p.137)

TEMPERATURE (C)	AVERAGE RESISTANCE
1350	0.201
1250	0.195
1150	0.188
1050	0.181
950	0.174
1450	0.206

9417276 0855



APPENDIX C

MODIFIED TCLP PROCEDURE

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MODIFICATION OF TOXICITY CHARACTERISTIC LEACHING PROCEDURE FOR WASTE FORM DURABILITY TESTING (FOLLOWING METHOD 1311)

1.0 APPLICABILITY

This procedure describes the method to perform the Toxicity Characteristic Leaching Procedure (TCLP) for waste form durability testing and to prepare the leachate for metals analysis by Inductively Coupled Plasma (ICP) Spectroscopy.

2.0 DEFINITIONS

9443276.0858

TCLP - Toxicity Characteristic Leaching Procedure
ASTM Type II water - DI water

3.0 RESPONSIBLE STAFF

- Responsible engineer
- Technician.

4.0 PROCEDURE

The major difference between this procedure and the TCLP by Method 1311 is the size fraction of the sample used. In order to provide greater comparability between samples and to provide a more controlled surface area for leaching, a controlled size fraction is used (+1 mm/-4 mm) rather than the standard -9.5 mm fraction required by Method 1311. If it is desired to compare results to the Method 1311 procedure for the TCLP metals, then this procedure can be followed using a sample crushed to -9.5 mm and quantitatively transferred to the extraction bottle. Another difference is the lack of acidification of the leachate prior to analysis. Experience has shown that acidification of the leachate interferes with the ICP analysis, likely a result of the formation of formic acid from the sodium acetate buffer.

4.1 MATERIAL LIST

All chemicals must be reagent grade.

1N HCl
1N NaOH
Glacial acetic acid
Ultrex nitric acid
ASTM Type II water
125 or 250 ml Extraction bottles made of HDPE, PP, PVC, PTFE
Disposable filter unit (PVC) with a 0.45μm cellulose nitrate filter

18 mesh or 1 mm sieve
5 mesh or 4 mm sieve
Hammer
Chisel
Sample vials
Hot plate
Thermometer
500 mL beaker or Erlenmeyer Flask
9.5 mm sieve (optional)
Pipette

Note: Measure all pH values to X.XX, except for cases in the preliminary evaluation where it is apparent that the pH is much less than 5.0. Use a balance with a readout of X.XX g.

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4.2 EXTRACTION FLUID PREPARATION

EXTRACTION FLUID #1

1. Dilute 5.7 mL of glacial acetic acid to 500 mL with ASTM Type II water (DI water).

2. Add 64.3 mL of 1N NaOH, dilute to 1L, and mix well.

3. Measure the pH of the extraction fluid and record. If the fluid was prepared correctly, the pH should be 4.98±0.05.

EXTRACTION FLUID #2

1. Dilute 5.7 mL of glacial acetic acid to one liter with ASTM Type II water.

2. Measure the pH of the extraction fluid and record. If the fluid was prepared correctly, the pH should be 2.88±0.05.

4.3 SAMPLE PREPARATION

1. Break the glass from the crucible. Use pieces of sample which are free from attached crucible material. If this is not possible due to the small sample size, remove as much of the crucible as possible before size reduction.

2. Crush and screen the sample into two size fractions; +18/-5 ($1mm<d^P<4mm$) and -18 mesh ($dp<1mm$). A little more than 5 g of each size fraction are required. If replicate extractions are desired, about 5 g of the +18/-5 mesh screening are required for each extraction.

3. Pass a magnet over the +18/-5 mesh sample prior to transferring to the sample bottles to remove any metal contamination resulting from the sample crushing.

4. Transfer the screens into appropriately labeled bottles.

4.4 PRELIMINARY EVALUATION

Note: If previous tests have shown that the sample will clearly require extraction fluid #1 this step should be omitted and a note of explanation made on the data sheet. Nearly all glasses will use extraction fluid #1.

1. Transfer 5.0 g of the -18 mesh sample to a 500 mL beaker or Erlenmeyer Flask.

2. Add 96.5 mL of ASTM Type II water and 3.5 mL of 1N HCL. Slurry briefly, heat to 50°C ±2°C, and hold for 10 minutes.

3. Allow the solution to cool to room temperature and measure and record the pH.

4. If pH<5, use the extraction fluid #1. If pH>5.0, use extraction fluid #2.

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4.5 EXTRACTION PROCEDURE

1. Measure and record the tare weight of the extraction bottle.

2. Add about 5.0 g of the +18/-5 mesh sample. Measure and record the weight of the solid added.

3. Add an amount of the appropriate extraction fluid equal to 20 times the weight of the solid added. Record which extraction fluid used and measure and record the weight of the fluid added.

4. Close the bottle tightly and place in the TCLP tumbler.

5. Repeat the above for up to 11 different samples. Also prepare a blank by placing 100 g of the appropriate extraction fluid in an extraction bottle. Measure and record the initial pH of the extraction fluid blank.

6. Tumble the extraction bottles at 30 ± 2 rpm for 18 ± 2 hours at room temperature. Record starting date and time, finish date and time, and the ambient temperature.

7. Remove the bottles from the tumbler and filter each leachate through a fresh filter unit.

8. Measure and record the pH of each extract.

9. Prepare a 3X dilution by adding 7 mL of leachate and 14 mL of ASTM Type II water into a labeled sample vial.

10. Analyze the extract as soon as possible using appropriate methods and procedures. Do not acidify the samples as acidification creates problems with the ICP analysis of metals.

11. Dispose of the solutions following appropriate procedures.

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APPENDIX D

TCLP CONCENTRATIONS FOR SOIL FINES AND VITRIFIED SOIL FINES

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Table D-1. TCLP Concentrations for Soil Fines and Vitrified Soil Fines. (Sheet 1 of 2)

TCLP Concentrations for Soil Fines and Vitrified Soil Fines* (all concentrations in ppm)												
Element	Detection Limit	Surrogate Melts										
		SF1 Glass	SF2 Glass	SF3 Glass	SF4 Glass	SF5 Glass	SF6 Glass	SF7 Glass	SF8 Glass	SF9-1 Glass	SF9-2 Glass	SF9-3 Glass
Ag	0.005											
Al	0.030	0.1575	0.2139	0.1887	0.3276	0.2088	0.2874	0.2814	0.1155			0.1257
B	0.010											
Ba	0.003											
Be	0.003											
Bi	0.060											
Ca	0.010	0.4602	0.2859	0.7368	0.3735	0.4776	0.4896	0.3492	0.2952	0.3435	0.4287	0.3858
Cd	0.006											
Ce	0.040											
Co	0.010											
Cr	0.020											
Cu	0.006											
Dy	0.006											
Eu	0.004											
Fe	0.005	0.1953	0.1989	0.2142	0.2307	0.2115	0.3243	0.2679	0.3684	0.1527	0.2532	0.2394
K	0.300											
La	0.010											
Li	0.005											
Mg	0.060	0.1467	0.1824	0.2109	0.2643	0.1881	0.2505	0.2451	0.0432	0.0342	0.0480	0.0939
Mn	0.003											
Mo	0.010											
Na (low)	0.050											
Na (high)	5.000											
Nd	0.020											
Ni	0.020											
P	0.080											
Pb	0.080											
S	0.080											
Si	0.010	0.4716	0.4812	0.4818	0.5712	0.4446	0.6882	0.5682	0.5280	0.3936	0.4755	0.4716
Sn	0.080											
Sr	0.003											
Te	0.060											
Ti	0.003											
V	0.010											
Y	0.003											
Zn	0.010											
Zr	0.010											

* A blank entry indicates that the concentration was less than 2 times the detection limit.

Table D-1. TCLP Concentrations for Soil Fines and Vitrified Soil Fines. (Sheet 2 of 2)

TCLP Concentrations for Soil Fines and Vitrified Soil Fines* (all concentrations in ppm)									
Element	Detection Limit	100 Area				300 Area			
		Soil	SFR1	SFR2	SFR3	Soil	SFR1	SFR2	SFR3
		Soil	Glass	Glass	Glass	Soil	Glass	Glass	Glass
Ag	0.005					0.0362			
Al	0.030	0.2061	0.3189	0.1782	0.1917	7.0533			0.1527
B	0.010					0.0467			
Ba	0.003	0.4665				9.5799		0.0207	
Be	0.003								
Bi	0.060								
Ca	0.010	99.6047	0.5138	0.7670	0.4076	130.2047	0.4451	0.7133	0.7712
Cd	0.006								
Ce	0.040					0.2771			
Co	0.010								
Cr	0.020					0.1220			
Cu	0.006					1.8977	0.0740	0.0965	0.0542
Dy	0.006								
Eu	0.004								
Fe	0.005		0.1259	0.6239	0.3818	0.0518	1.1714	0.5507	0.5012
K	0.300	5.5001	0.9461	0.6473	1.0820	6.3461	0.3485	0.2354	0.2717
La	0.010					0.0588			
Li	0.005								
Mg	0.060	7.6610				14.3780		0.1148	0.1217
Mn	0.003	0.2757				0.2778			
Mo	0.010								
Na (low)	0.050								
Na (high)	5.000								
Nd	0.020	0.1809	0.0291	0.0207		0.2556	0.0087		0.0072
Ni	0.020					0.2007			
P	0.080								
Pb	0.080								
S	0.080	0.4392				0.5211			
Si	0.010	5.8569	0.4584	0.5073	0.4491	34.6779	0.5715	0.4740	0.5412
Sn	0.080								
Sr	0.003	0.3350	0.0026	0.0026	0.0026	0.9209	0.0023	0.0026	0.0026
Te	0.060								
Ti	0.003								
V	0.010								
Y	0.003								
Zn	0.010	0.1131				0.0729		0.0513	
Zr	0.010								

* A blank entry indicates that the concentration was less than 2 times the detection limit.